THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CI. No. 2330.] LONDON, JANUARY 7, 1908. [60TH YEAR. PRICE 6d.

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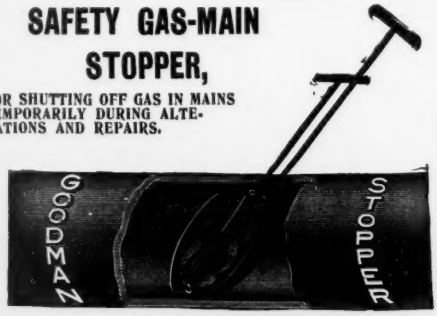

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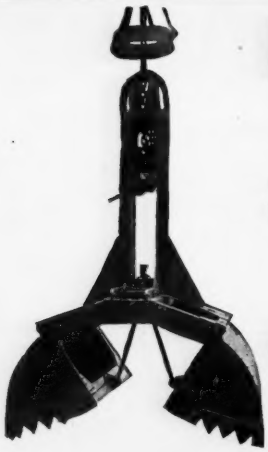

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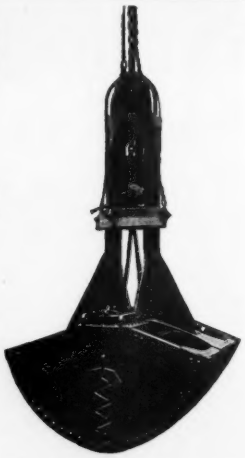

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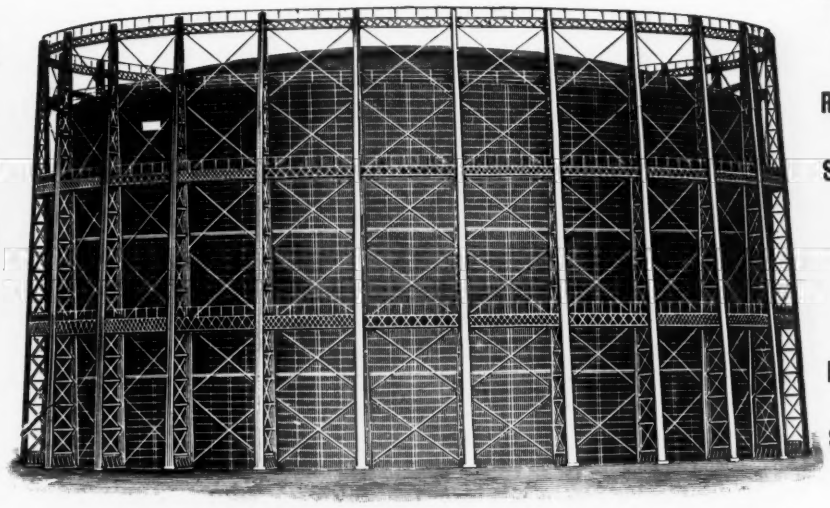

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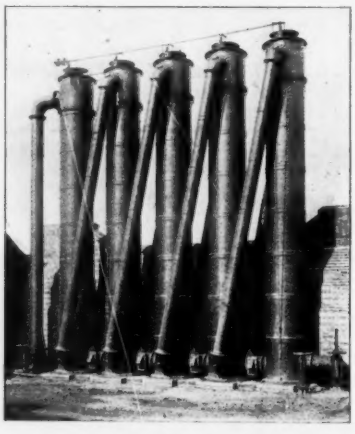

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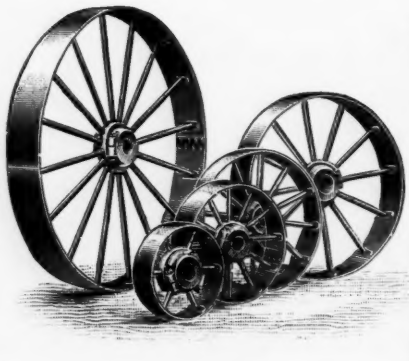

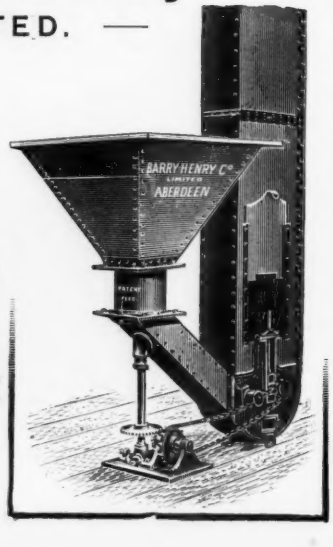

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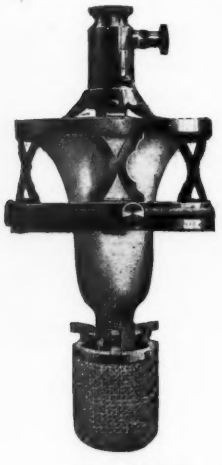

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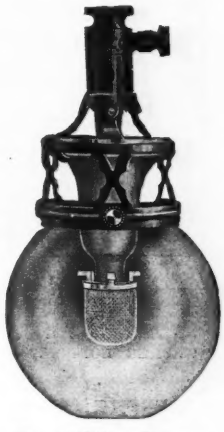

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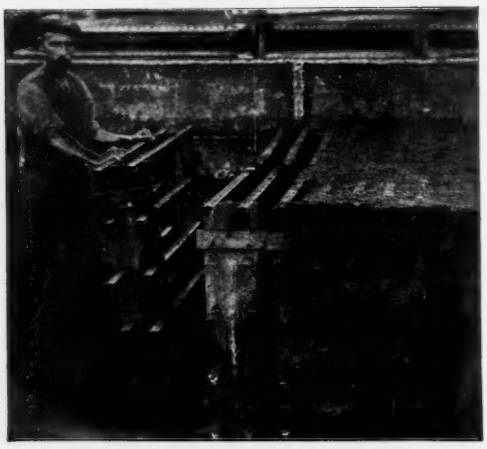

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Belfast (Second)	4,500,000
Berlin—Charlottenburg	2,500,000
Berlin—Rixdorf	650,000
Berlin—Rixdorf (Second)	700,000
Birmingham	1,500,000
Bochum, Westphalia	530,000
Bognor	100,000
Bordentown, N.J.	125,000
Bournemouth	1,000,000
Bournemouth (Second)	500,000
Bremen, Germany	550,000
Bremen, Germany (Second)	950,000
Brentford	1,200,000
Bridgwater	200,000
Bridlington	150,000
Bridlington (Second)	200,000
Brieg, Silesia	100,000
Brighton	1,750,000
Brighton (Second)	1,850,000
Bruges, Belgium	200,000
Brussels—Anderlecht	350,000
Brussels—Forest	1,000,000
Brussels—St. Josse	1,000,000
Brussels—Ville	750,000
Brussels—Ville (Second)	750,000
Brussels—Ville (Third)	1,500,000
Brussels—Ville (Fourth)	350,000
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Budapest (Second)	1,750,000
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Chigwell	350,000
Chorley	300,000
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Commercial (Second)	850,000
Commercial (Third)	1,250,000
Commercial (Fourth)	2,000,000
Copenhagen	700,000
Copenhagen (Second)	2,500,000
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Coventry (Second)	600,000
Cracow, Galicia	200,000
Croydon	1,250,000
Croydon (Second)	625,000
Croydon (Third)	625,000
Deventer, Holland	150,000
Deventer, Holland (Second)	200,000
Dorking	150,000
Dublin	2,000,000
Dublin (Second)	2,000,000
Dublin (Third)	650,000
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Guildford (Second)	200,000
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Heidelberg, Germany	200,000
Holyoke, Mass.	600,000
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Lea Bridge (Second)	350,000
Lea Bridge (Third)	400,000
Leeuwarden, Holland	400,000
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Liége, Belgium (Second)	750,000
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Liverpool (Second)	4,500,000
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Maidenhead (Second)	225,000
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Malta	400,000
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Manchester (Second)	3,500,000
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McKeesport, Pa.	500,000
Merthyr Tydfil	300,000
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Newburgh (Second)	250,000
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New York	4,000,000
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North Middlesex (Third)	75,000
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Ostend, Belgium	100,000
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Posen, Germany (Second)	700,000
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Reading	1,000,000
Redhill	275,000
Redhill (Second)	300,000
Reichenberg, Bohemia	200,000
Romford	300,000
Romford (Second)	350,000
Rotterdam, Holland	850,000
Rotterdam, Holland (Second)	1,500,000
Rotterdam, Holland (Third)	750,000
Rotterdam (Fourth)	750,000
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St. Gallen, Switz. (Second)	225,000
St. Joseph, Mo.	750,000
Santiago de Cuba	400,000
Scarborough	800,000
Shanghai	225,000
Shanghai (Second)	225,000
Southampton	800,000
Southampton (Second)	500,000
Southgate	400,000
Southport	750,000
Southport (Second)	900,000
Stafford	500,000
Staines	600,000
Stockholm	1,500,000
Stockport	600,000
Stockport (Second)	600,000
Stockport (Third)	400,000
Stockton-on-Tees	500,000
Swansea	750,000
Swansea (Second)	1,000,000
Swindon	300,000
Sydney—Harbour	500,000
Sydney—Harbour (Second)	500,000
Sydney—Mortlake	500,000
Sydney—Mortlake (Second)	500,000
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Taunton (Second)	350,000
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The Hague, Holland (Second)	500,000
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Tottenham	750,000
Tottenham (Second)	750,000
Tottenham (Third)	350,000
Tottenham (Fourth)	1,000,000
Tottenham (Fifth)	1,000,000
Tunbridge Wells	1,000,000
Utrecht, Holland	1,000,000
Utrecht, Holland (Second)	1,000,000
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Watford (Second)	350,000
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Weston-super-Mare (Second)	350,000
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Winchester (Second)	125,000
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Zwolle, Holland (Second)	200,000

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San Paulo, Brazil	700,000	Nictheroy, Brazil	250,000	Crefeld, Germany	500,000
Reval, Russia	350,000	Maidstone	500,000	Düsseldorf, Germany	1,000,000
Gelsenkirchen, Westphalia	175,000	Nelson	400,000	Brussels-Koekelberg	1,000,000
Graudenz, West Prussia	200,000	Brussels—St. Gilles	1,000,000	South Shields	650,000
Schwelm, Westphalia	100,000	Barmen-Rittershausen	500,000	Brussels–St. Josse (2nd)	600,000
Hong Kong	450,000	Rotterdam (5th)	600,000	Reichenberg (2nd)	200,000
Kampen, Holland	350,000	Shanghai (3rd)	1,600,000	Lausanne, Switz.	250,000
Ostend (2nd)	200,000	Carlsruhe, Germany	500,000	Gelsenkirchen (2nd)	350,000
Verviers, Belgium	1,000,000				

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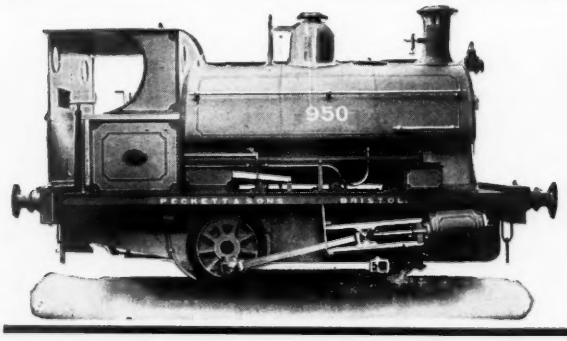

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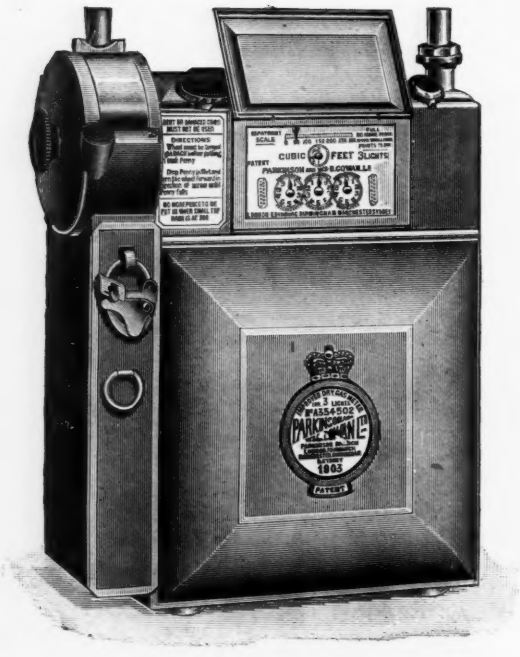

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EDITORIAL NOTES—GAS, &c.

A New Year's Surprise.

"THE Directors are most anxious to reduce the price of gas "at the earliest possible moment; and it is to be hoped that "the price of coal will not be long maintained at its present "high figures. As soon as the price of coal allows, the "Company will give their consumers the benefit of the re-"duction in the price of gas." So said the Directors of the Gaslight and Coke Company in notifying the consumers in September last of the reimposition of meter-rents, instead of raising the price of gas in consequence of the higher prices ruling for coal and oil. We knew the Company would keep faith with the public in this matter; but it was not anticipated that, in three months from the commencement of the re-establishment of the meter-rents, the Directors would be in the position to redeem their promise, by bringing down the price of gas by 1d. per 1000 cubic feet to 2s. 10d. The consumers are fortunate. The reimposition of meter-rents represented, in effect, an addition to the price of gas averaging to the ordinary consumers (the prepayment ones were not affected) ¾d. per 1000 cubic feet; the reduction of 1d. in the price of gas is, therefore, equivalent to the amount now paid by way of meter-rents and 25 per cent. besides—perhaps rather more than 25 per cent., inasmuch as, since the calcution was made, there has been a good advance in the total volume of gas sold. The reduction, too, rehabilitates—even if it does not immediately materially affect—the position of the proprietors. When reimposing meter-rents, the Directors gave their bond that they would sacrifice any dividend which would accrue, under the operation of the sliding-scale, by reason of the additional revenue furnished by meter-rents enabling them to keep the price of gas about a penny lower than it would otherwise be. But, as a matter of fact, the present dividend of £4 8s. per cent. on the ordinary stock was not threatened, seeing that at the 2s. 11d. price, the proprietors were actually entitled to £4 10s. 8d. per cent., and £4 8s. is the statutory dividend with gas at 3s. per 1000 cubic feet. By-the-by, the £4 8s. per cent. return to investors is not very attractive, as the price of the Company's stock attests. But the prospects are more favourable now than even before for the proprietors (if the coal market eases) enjoying at a no distant date at least a dividend of £4 10s. 8d. It must be recognized by the local authorities and the pubiic alike that the Company are now doing, and will continue to do, their duty to the consumers; but, in doing this duty, the proprietors should also participate in a measure in the improved conditions of the concern.

This new year's surprise for the consumers is the answer to the minority of members of the present London County Council who are the remnant of the former majority who, in or out of office, harbour animosity towards public services provided by private enterprise. What comes now of their accusations, when the reimposition of meter-rents was proposed, of some occult motive detrimental to the public on the part of the Company? They may now be left to find a suitable answer; there being greater present interest for our readers in turning to the advantages that the Company have realized from their trading in the past half year, which enable them to make this early reduction in price, in face of the high cost of coal and oil. In the "Retrospect" published last week, it was hinted that there was good ground for anticipating that the Company's forthcoming accounts would make excellent showing; and the notice of the reduction forwarded, by instruction of the Directors, for publication, confirms what was said. Better prices have been received for residuals, the consumption of gas has increased, and there is the revenue derived from meter-rents. The meter-rents were estimated to produce only £60,000; so that it will be found, we believe, that the consumers are enjoying something to the good by the reduction of 1d. earlier than they would have done had the meter-rents not been re-established. The reduction is a smart justification of the policy of the Board, and one that was undreamt of by the most sanguine but a few months ago.

Parliamentary Work—Coalite and other Bills.

PARLIAMENT intends to start well in the new session. The date for reassembling has been officially fixed for Jan. 29—a fortnight earlier than last session. But in 1906 there was an autumn session, and therefore excuse for deferring the commencement of duties in 1907. On this occasion, members have enjoyed long relief from the growing exactions of parliamentary life; and consequently it may be expected they will come to their work refreshed and eager for the wordy fray. The session promises great scope for rhetoricians at St. Stephens. Matters of considerable domestic importance are to be discussed; but, for the most part, they are matters for which there is no general demand for legislation, and their birth is entirely traceable to fanatics and factions. Labour, too, intends that its requirements shall not be shelved; and there have been broad hints from the platforms during the recess that it will not be the fault of the Labour Party in the House of Commons if the session is not fruitful for labour at the expense of all other sections of the community. Old-age pensions figure large in their programme; and the old-age pensions demanded are to be universal in their application, and no one is to be called upon to directly contribute to them. The Government have committed themselves to do something in this direction. The promise was made last April, when the Chancellor of the Exchequer proclaimed his anticipation of having, at the end of the current fiscal year, the sum of £2,250,000, free and ear-marked for making a start with old-age pensions. The sum has been ridiculed as absurd and inadequate by more than one labour demagogue since the announcement was made. The subject, however, need not at present engage attention here; among other matters, it will come up for discussion as the session advances. But whatever one's personal feelings may be on this question of old-age pensions or any other affecting labour, let it not be forgotten that burdens imposed by an inordinate generosity to one section of the community, inflict an injury that will be generally felt with increasing intensity. Among other matters in which the gas industry will be concerned as promcters of Private Bills will be the attempted forcing by the Government of a quarrel with the House of Lords. The nonchalance of the Lords in regard to the threats issued against them is one of the amusing features of this passage in modern political life. Thank goodness there is no action within the power of the Government that can dislodge such an important component of our national constitution. In our own little way as a single industry (with, however, a big stake in the country), the revising power of the House of Lords has on occasion proved of inestimable advantage; and what is found in this regard within the history of the industry's legislation is true and important to a greater degree when applied to the affairs of the country as a whole.

From public to private legislation. The two promise in point of interest to occupy diametrically opposite positions. There are fewer Private Bills than ever; and that they are imposing in condition cannot be claimed as a characteristic. With the constant menacing of vested interests, and the Bank rate ruling high, there is nothing much other than sheer necessity to stimulate application to Parliament for an extension of powers at the present time. Our sketch of the gas legislative programme just lately showed that it was not in any degree exceptional from its general surroundings. The Bills as lodged are now before us; and their examination does not alter in any whit the estimate already formed of them on shallower information. From them, however, it is not difficult to select the measure that will be the cynosure for the gas industry during the session.

It is the Metropolitan Power Gas Bill of the British Coalite Company, in which they seek the necessary sanction to tear up the streets of West Ham, East Ham, Barking Town, and part of Woolwich north of the Thames, but propose in return the minimum obligation being imposed upon themselves. There is no reason why power-gas companies should receive any special privileges not accorded to other statutory companies. This power-gas business of the Coalite Company is the pendant of a speculative business yet untried, and with no guarantee of endurance. Being a subsidiary business, the Coalite Company do not propose anything in the Bill in regard to capital for the power-gas concern, nor any limitations in respect of dividend—their financial obligations beginning and ending with what they may or may not do in the transactions between their customers and themselves. In view of the subsidiary character of the business, and its permanence or otherwise being totally dependent upon the measure of success of the coalite business, it will be the duty of Parliament, before allowing the Company to tear up the streets in the industrial section of London, and to add to the already, in parts, congested state of the subsoil, to inquire as to the possible chances of sufficient success attending the coalite speculation to warrant the continued existence of the Company.

This power-gas business was unpremeditated by the promoters of the Coalite Company but a few months ago; there having been excessive sanguineness on their part that gas companies would jump at their offer to supply them with gas in bulk. But apart from no particular desire to befriend a competitor in fuel, and place that competitor in a better position for carrying on his trading attacks, the gas companies consistently, in view of their parliamentary obligations, prefer to maintain the production of gas they have to distribute under their own direct supervision. However, the gas produced in the making of coalite must be disposed of in some manner; and there is only one alternative market, and that is to supply the gas for power purposes. The Bill shows the tight corner in which the Coalite Company were fixed in this matter of the disposal of the gas; and even if the Company can satisfy Parliament that it will be (to use words appearing in the preamble of the Bill) a "public and "local advantage" to confer upon them powers to canalize the East-end of London for distributing this power gas, it is clear there can be little (if any) real profit in the auxiliary business, and at best the demand for a power gas at 6d. or 7d. per 1000 cubic feet, even though possessing a calorific power of 500 B.Th.U., must be limited in the area mapped out as the supply district. There will be the capital cost of storage and the distribution works—all unpremeditated capital expenditure—and it is the experience of electricity power companies that, to get manufacturers to give up their accustomed methods, it is necessary to have at hand a decent amount of capital wherewith to supply machinery on easy-hire terms. When upon this provision come the distribution, general management, and other expenses, the prospect vanishes of fat profits in supplying a 500 B.Th.U. (gross) gas at 6d. or 7d. per 1000 feet. We will give the Company their due. It is patent that they have, in fixing their prices, paid consideration to the serious competitors they will have to meet. They are proposing to engage in business with big consumers; the minimum consumption fixed at the 6d. rate being a million cubic feet per quarter. But with the 6d. (quality of supply does not seem to tell much with the big users of power gas), there will be some difficulty in persuading manufacturers that the scrapping of their producer gas plants—yielding a gas of from 125 to 145 B.Th.U. (net) at a much lower price per 1000 cubic feet, and a gas good enough for their purposes—is going to be of any advantage to them. We cannot see that the Company can prove that any public benefit will accrue from the distribution of this bye-product of the manufacture of coalite, nor can we see that the Directors can satisfy those capable of judging—they may some shareholders—that there is profit in the business.

The Bill, as will be seen from tbe digest elsewhere of its more important provisions, follows closely the lines of the South Staffordshire and other Power-Gas Acts; but neither the South Staffordshire nor any other Power-Gas Company has shown that the business of power-gas supply can stand alone and be lucrative. Their experience should rather act as a deterrent to, than inspire, any other company entering this field in the expectation of finding wealth in it. The prices mentioned in the Bill are not perpetual fixtures. Periodical revisions are arranged for, and also when the price of slack delivered on the works exceeds 8s. per ton (at the present time, the quotations of the best classes of slack exceed that figure). The South Staffordshire Company have 6s. named in their Act. Like the latter Company, too, the Coalite Company bind themselves to distribute gas with a distinctive and readily perceptible smell; but unlike the pattern for the lines of their Bill, they do not propose to put themselves under a 14 per cent. restraint for carbon monoxide and a test. But they do propose to enter into a bond, with a penalty attached, not to allow the gas to be used for illumination—the gas undertakings in the area to be given the right on discovery to proceed for the recovery of the penalty. Nor have the Company the impudence to claim any monopoly in the supply of power gas; the provision proclaiming this also following the lines of one in the South Staffordshire Act. But notwithstanding their complete evasion of illumination, in their power-gas proposals the Coalite Company are making an onslaught on the rights and privileges of gas companies; and they may feel quite certain they will not be allowed a "walk over" in Parliament.

About the miscellaneous Bills reviewed in other columns to-day, there is not much to say. They are all promoted by companies seeking incorporation and parliamentary powers. On the question of capital, the Swansea Valley Bill invites remark. The capital proposed is large for such a concern—£50,000 of ordinary and one-fourth borrowing powers; making £62,500 in all. The Company are proposing to commence business with the Pontardawe works, the Ystalyfera works, and the small distributing system attaching to private works owned by Messrs. Player at Clydach. The last returns to hand show that the Pontardawe works only made in the year 7 million cubic feet of gas, and the Ystalyfera works 5 millions—together 12 millions! It will be of public advantage if Parliament can be satisfied, before granting the Act, whether or not there is a professional promoting firm or concern at the back of this Bill. We do not know; but the capital and character of the district suggest inquiry. It is to be hoped that no more Gas Bills will be passed through Parliament to be made an object of commerce in the City, and personal enrichment at the public expense. With reference to the illuminating power of gas, there are two Companies among those whose Bills are under notice who are asking for an illuminating standard of 12 candles; the others mention 14 candles. We cannot, however, understand why the Bognor Company should be suggesting the testing of 14-candle gas, at a fixed 5 cubic feet rate, by the "London" No. 1 argand burner, when the "Metropolitan" No. 2 burner is available. Parliament may be relied upon, in this matter, to protect the Company against themselves. Another peculiar thing is that three of these Companies are proposing to define the limits of discounts, when, as the model clauses show, a little extension of section 13 of the Gas-Works Clauses Act, 1847, will give practically absolute liberty. Excepting a change in the form of the end subsection of the prepayment meter clause in the Swinton and Mexborough Bill, to provide against not receiving 10 per cent. on the cost of the meter where fittings are not supplied, there is nothing further in the Bills that calls for special note here.

Rating and the Prepayment System.

The Ipswich Board of Guardians have had enough litigation over the question of whether or not, in the assessment of a gas undertaking, prepayment meters, stoves, and fittings should be part of the tenant's capital, upon which an allowance should be made. As reported last week, they have now resolved not to appeal against the decision of Justices Channell, Bray, and Sutton, which confirmed the view of the Recorder of Ipswich that prepayment meters, stoves, and fittings were just as much chattels (and not part of the hereditament) as ordinary meters, in respect of the cost of which it was decided in the Lee case over forty years ago that a deduction ought to be allowed. The much-disputed point therefore rests in favour of gas undertakings; and in regard to it, Courts of Quarter Sessions will henceforth be bound by the declaration of the Higher Court. There will, of course, be rating authorities who will wish that the case had been carried to appeal; but we rather admire the Ipswich Guardians for refusing to be the paw in any further attempt to pull the chestnuts out of the fire, and in so doing burning themselves over what appears to be a very obvious point. The Ipswich Guardians have the satisfaction of knowing that in not going beyond the King's Bench Division they are following precedent in

the Lee case, for that case (which determined several important questions in addition to the one of the deduction for meters) was not prosecuted beyond the Queen's Bench Division. The ratepayers of Ipswich will be thankful that the Guardians have resolved to squander no more money over the case. The Recorder delivered such an explicit pronouncement upon the matter, and did not give any encouragement to taking the matter to appeal, that whatever blame attaches to the spending of a heavy sum in carrying the matter to the Higher Court must rest entirely at the doors of the Guardians. However, the gas industry have no cause of complaint; it has relieved perhaps some less fortunate gas company than that at Ipswich from establishing a point over which one would have thought there could have been no question. The day may come when some ardent rating authority will feel disposed to pursue the matter further; but they would be taking in hand a serious thing, seeing that, at both Quarter Sessions and in the King's Bench Division, the Courts would be held bound by the judgment delivered on December 18 last by three learned Judges already named.

Electricians and Flame Arcs for Street Lighting.

More illumination curves and more information about the City experimental lighting with flame arc lamps have been published. A fortnight ago, in "Electric Lighting Memoranda" we showed that Mr. Haydn Harrison had, in the "Electrical Review," been disporting himself among illumination curves obtained from the City lighting, and that articles and curves (obtained by other observers) had also appeared in "Electrical Engineering." And further, that between the two sets of curves there was so much confusion as to the candle-feet obtained that to ask for reliance being placed on either set was asking for a measure of faith that few would be prepared to hold. Now the "Electrician" publishes another set of curves, obtained by the use of the Trotter photometer; the measurements being taken 3 feet from the ground. The results examined in conjunction with those published in the other two papers intensify the confusion. On this occasion, however, we will not deal with the candle-feet figures which so ungraciously decline to be confirmatory between observer and observer; and, *a fortiori*, because it was not long since that the "Electrician" itself discredited such figures by the remarks that "there "is some difficulty in making satisfactory measurements of "low illumination such as are likely to occur as minima," and "a great deal of care is necessary in such measurements "because an arc lamp is by no means a very steady source of "illumination." We are, by these oracular statements, justified in regarding these illumination tests published in the "Electrician" and other papers with grave suspicion.

But we would direct the attention of our contemporary to its own graphic illustration of the results of the tests—to the height of the peaks given as maxima for the flame arc lamps, and to the long precipitous decline before reaching minima; and we ask: Does this suggest good and uniform street illumination? And does not the lower curve for the incandescent gas lighting (assuming it is correct) suggest that a less flight between maximum and minimum candle-feet, with lamps placed at shorter distances than is the case with flame arc lamps, will give a more equable illumination along the street surfaces? This is the real lesson of these curves—that with the somewhat lower candle power incandescent gas-lamps, spaced at shorter intervals, and at less heights than the sportive flame arc lamps, the differences between maximum and minimum are not so severe, and consequently the gradations of surface illumination show greater regularity. But as compensation for the big variation between maximum and minimum in the case of the flame arc lamps, our contemporary states that the illumination half-way between the Cannon Street lamps—that is to say, about 58 feet from any lamp—was equal to the illumination obtained only 28 feet away from any gas-lamp in Queen Victoria Street, and in the latter case the illumination about half-distance between the gas-lamps was too small to be measured with the instrument used. So much the worse for the usefulness of the Trotter photometer. Mr. Haydn Harrison appears to have had no difficulty in determining that the minimum direct illumination in Queen Victoria Street was 0·1 candle-foot. The Trotter photometer could not measure it! Poor photometer and badly-treated high-pressure gas-lamps! Why are these lamps arranged on the common hit-and-miss principle—thus . · . —if it is not that every three lamps shall combine in bringing influence to bear upon what is the point of lowest illumination from any individual lamp, and thus produce a greater uniformity of illumination?

There is another passage in the "Electrician" article pregnant with meaning of which perhaps the writer was unconscious. The flame arcs in Cannon Street are, it will be remembered, suspended on wires 28 feet in the air. Says our contemporary: "The effect of placing the lamps at "this high level is very marked; for whereas the illumina-"tion in the immediate vicinity of the lamps is greatly re-"duced in Cannon Street, the distribution of the light is "much improved; and the minimum illumination is *many* "*times that in the case of Holborn Viaduct*, where the same "type of lamp is placed at a lower level." Electrical testimony placed side by side is extremely entertaining, if not instructive. Remarks "Electrical Engineering:" "It is "interesting to note the *small difference* between the aver-"age, and more particularly between the minimum, illumi-"nation in the two cases [Cannon Street and Holborn];" and, further, "the illumination from the centrally suspended "lamps would have been greater had it been practicable to "place them closer to the ground." We should like to see our electrical contemporaries trying to reconcile these antagonistic statements. Supposing we accept the statement of the "Electrician," it proves, in the first place, that flame arc lamps are extravagant in low-pitched situations; and regarded from the scientific point of view that, to get the most extended distribution from them, they must be placed at a great height, and, the greater the height, the greater the waste of those remarkable nominal illuminating powers on which their cost per candle power per annum is based. We would suggest that, if the lamps were placed still higher, the greater would be the area "illuminated;" but the greater the waste of the nominal candle power in the intervening space. There is a fundamental law in photometry which is simply stated by Dibdin; and our contemporary should apply it to the reputed nominal candle powers of flame arcs and to their own statement quoted above. It is as follows: "The "first law of photometry is that relating to inverse squares. "Light proceeds from a given radiant in all directions in "straight lines. Consequently, it follows that as these lines "recede farther from the starting-point, they separate more "and more, and thus a less volume of light impinges upon "a given object the more remote its distance may be, and "this reduction is in inverse ratio to the square of the dis-"tance." We will leave this point for the consideration of our friends, showing as it does what bad light-sources of illumination flame arcs must be in having to waste so much of their potential lighting energy to secure a modest illumination of surfaces at a reasonable distance from them. There are two or three other points in the "Electrician" article to which it is proposed to refer next week.

A Cramped Condition at Belfast.

Once more the Belfast Gas Committee are face to face with the fact that, if the work of the exceedingly prosperous undertaking of which they have charge is to be as efficiently conducted in the future as it has been in the past, important extensions must be forthwith put in hand; but at the very outset of their scheme, they have again had the misfortune to encounter opposition on the part of a section of the Council and the ratepayers. This, as our readers will be aware, is in connection with the proposed site of the new works—certain land in Ormeau Park, which possesses facilities rendering it, in the opinion of the Gas Manager (Mr. Robert Sharpe) and his Committee, peculiarly suitable for the purpose in view. In coming to this conclusion, they have no doubt been largely influenced by the fact (mentioned by Mr. Sharpe in the course of a report which is reproduced in our news columns to-day) that both Mr. Corbet Woodall and the late Mr. Foulis, when they were consulted, gave it as their opinion that there was no site in the neighbourhood of Belfast so suitable for the construction of gas-works as the low-lying ground in Ormeau Park. In spite of all this, as already remarked, objections to the suggestion have been voiced in various quarters; and the matter is still unsettled—it being seemingly the intention to hold a special meeting of the Council so as to afford an opportunity for thoroughly discussing the question. Meanwhile, the Chairman of the Gas Committee has undertaken to have the ground in the park which it is proposed should be used marked out clearly for

the information of the members; and when the matter is thus definitely set forth, it will rest with the Council either to assent to the Gas Committee's scheme or bring forward some other which will possess at least equal advantages when looked at fairly from all points of view—for Mr. Sharpe's report does not admit of the entertaining of any doubt whatever as to the necessity of promptly making further provision for the manufacture of gas. It is pointed out that so long ago as 1880, when the output was 548 million cubic feet a year, as against 1969 millions at the present time, the need for new works was brought before the Corporation; but no action was taken. In 1891, a new retort-house was erected; and then in 1893, the proposal to take a part of the park was brought forward—and successfully opposed. Under Mr. Sharpe's predecessor (Mr. James Stelfox), a carburetted water-gas plant was then installed; and this has sufficed up to the present date. Now, however, in the fulness of time, and by the progress of a thriving industry, the limit has again been reached; and the representatives of the ratepayers, who are owners of the gas undertaking, once more find themselves confronted with the question of what is best to be done— a query to which, it will be noticed, Mr. Sharpe does not neglect to provide an answer.

Misrepresentation by Suppression.

Not for the first time, we have to complain of the misrepresentation of the "Electrical Times" by the suppression of essential facts. There are two instances in the current issue. In "Chesterfield Junior's" comments on the annual accounts of the Ramsgate and District Electric Supply Company, Limited. this statement appears: "The business has to face a keen competitor in the shape of the Municipality, which supplies gas from its own works at 2s. 8d. per 1000 cubic feet; and, as if this were not sufficient, the Company has also to subsidize its municipal competitor to the tune of 2s. per ton in the shape of coal dues." The first part of the statement is true; the second part is absolutely false. If anything, it is the Electricity Company who have benefited at the expense of the Gas Department; and this a few figures will make abundantly clear. During the year (1906), the Electricity Company paid to the borough fund in rates £39, and in coal dues approximately £30. The analysis of the Company's accounts in the "Electrical Times" shows that their coal bill for the year amounted to £227, which is equal to about 300 tons of coal. During the same period, the Corporation Gas Department paid to the borough fund for coal dues £2166. They also paid in rates, £1461, and handed over the surplus of the preceding year amounting to £1002. These figures make up a total of £4629. No comment is needed to emphasize the senselessness of the statement by "Chesterfield Junior." In the same issue, "Meteor" refers to the gas suffocation cases at Silvertown and Swansea at Christmas time—making, in his customary ornate style, the remark that "cases of retail gas assassination are monotonous, but these are wholesale." It did not suit "Meteor's" book to state that the evidence at the inquest disclosed that one of the victims in the Silvertown case had had "several drinks" during Boxing Day, that he returned home between 12 and 1 a.m. next morning, and that it was found later that the prepayment meter and inlet-pipe had been violently pulled away from the wall, as though someone had clutched at the pipe to save himself from falling. And as to the Swansea case, the police found the gas-bracket in the room was broken off—not the gas-tap open. The survivor in this instance said he could "remember little, excepting that the gas-bracket, so far as he saw, was all right when he went to bed." We may be pardoned for thinking, on this evidence, that strong drink, and not gas was the primary cause of these fatalities. The "Electrical Review" also notices these cases; but again not a word is said as to the evidence to which attention is here called, although published in our columns last week.

The Lesson of a Strike.

The soundness of the advice contained in the old adage "Look before you leap" would doubtless now be freely admitted by the 200 or so misguided employees of the Alliance and Dublin Consumers' Gas Company who were so ready to throw aside good work in the belief that they could not be done without, and so would be able to resume it on their own terms. As is usual in cases of strikes (in fact, it is an important consideration from the men's point of view, if their chances of success are to be rendered as great as possible), the employees left their work just at the time when such a course might be calculated to result in the largest amount of disorganization of the business—namely, the period of the year when gas is in most demand. Towards the end of November, the Official Delegate of the National Amalgamated Union of Labour wrote to the Directors of the Company making various "demands" on behalf of different sections of the men; and the reply to this was a refusal to recognize any outside interference. Thereupon the familiar meeting was held, at which the familiar resolution was passed regretting that the Directors declined to recognize the representative of the Union to negotiate the "just and reasonable demands" submitted, and expressing the determination to stop work unless these demands were conceded or the Board agreed to receive a deputation including the Union representative. The date on which this resolution stated that it was the intention of the men to cease work was Dec. 19, but on the 14th of the month the Union representative offered on behalf of the men to have the matter submitted to arbitration. This generosity was ignored; and the official thereupon advised the men to send a deputation to the Directors, which was done. After giving the question due consideration, the Board replied that, in view of the state of the labour market and the number of unemployed in Dublin, the men's demands were unjustifiable, and could not be complied with. On learning this, some days before Christmas, the men at once left their work; but after the lapse of less than a fortnight those for whom vacancies could be found were back again—sadder and, it is to be hoped, wiser, men than when they left their work—on the old terms, while others (who had to wait for an opportunity to resume work) were left to lament their folly. In thus deciding upon what was the right course, and firmly adhering to their decision, the Directors will meet with nothing but praise from those who have given serious thought to industrial problems. Of course, the consumers have had to suffer some inconvenience, and no doubt a good deal of anxiety has been entailed on the officials of the Company; but this cannot be considered too high a price to pay for the benefits which may be looked for as a consequence of the lesson which has been administered to men who had been at such pains to show how much they needed it.

Labour in Conference.

If one may judge from the appearance of the *agenda* for the forthcoming Labour Party conference, to be held at Hull later on in the month—there will again be no lack of discussion, whatever may be the result from the standpoint of practical achievement. Some of the subjects down for consideration—such as unemployment and old-age pensions—have, of course, already seen much service on like occasions; but there are also matters to be introduced relating to the constitution of the party, which may be relied upon to furnish plenty of life to the gathering. Schemes have been considered for the creation in London of an organization on the same lines as the one that exists in the Provinces, so as to bring the Metropolitan labour bodies together into a Labour Party. But owing to the "serious difference between the positions of the Labour movement in London and the country outside," it has not been thought advisable to do anything. It is recalled that in 1903 a conference was held in London with reference to the formation of a Labour Representation Committee; but the attempt was abortive. The hope is held out, however, that the situation in the Metropolis is now so rapidly changing that it will soon be feasible to make another attempt at organization. Recognition of the political power of women (even though they may not have votes) is contained in the following proposed addition to the constitution: "A national organization of women accepting the basis of this constitution and the policy of the party, and formed for the purpose of assisting the party, shall be eligible for affiliation as though it were a trades council, without having the right to vote in the election of the Executive." In addition to various amendments of the constitution, there are one or two particularly modest resolutions to be submitted. One of these is to the effect that "the time has arrived when the Labour Party should have as a definite object the socialization of the means of production, distribution, and exchange, to be controlled by a democratic State in the interest of the community; and the complete emancipation of labour from the domination of capitalism and landlordism, with the establishment of social and economic

equality between the sexes." From Liverpool will come a suggestion to instruct the party in the House of Commons to take such steps as shall safeguard the rights of civil labour, and prevent the possibility of military, naval, or civil servants being employed against the workers in times of industrial disputes. Perhaps there would not be the same objection to them taking the part of the strikers or agitators for whom it is thus sought to secure immunity to do as they please.

The Artificial Lighting of Schools.

In view of the large portion of the lives of children which is spent in school, it is unnecessary to emphasize the importance of the efficient lighting, warming, and ventilating of the class-rooms. The two latter branches of school hygiene do not come within the province of a gas manager; but the former branch does, and will continue to do until, if ever, he is superseded by the new specialist—the lighting engineer. His attention may therefore be usefully directed to the report by Dr. James Kerr, the Medical Officer of the Education Department of the London County Council, for the year ending the 31st of March last, which has lately been issued, and some extracts from which will be found in the last and present issues of the "JOURNAL." An investigation into the lighting of class-rooms was undertaken by Mr. Bishop Harman; and the results are embodied in Dr. Kerr's report. In the extract given last week, it was shown that the incandescent system of gas lighting possesses special advantages for schools; but that for desk work a proper shade is required, so as to minimize the black shadow caused by the brasswork of the burner, and effect a distribution of the light which will be practically perfect. To-day we give the portion of the report containing the results of the testing of four shades submitted; and it will be seen that the one formed with an angle of 90°—the last in the series shown elsewhere—is considered to fulfil all the conditions required for a school globe. The full value of a good burner and globe, however, is not obtained unless the lights are properly arranged; and therefore the report contains some useful suggestions on this matter which may be commended to the attention of both gas managers and fitters.

Reduction of Price by the Gaslight and Coke Company.

Last Friday, Mr. H. Rayner wrote: The Directors of the Gaslight and Coke Company have the pleasure to announce that the price of gas will be reduced from 2s. 11d. to 2s. 10d. per 1000 cubic feet, as from the taking of the meter indices at the end of the December quarter, 1907. This reduction has been rendered possible, notwithstanding the great increase in the cost of coal and oil, by better prices received for residuals, an increase in the demand for gas, and further by reason of the income derived from meter-rents."

The number of applications made at the Patent Office for the protection of new inventions during the year just ended amounted to 28,769. In 1906 and 1905 the totals were 30,002 and 27,577.

At the meeting of the Institution of Mechanical Engineers on the 17th inst., the third report of the Gas-Engine Research Committee will be submitted by Professor F. W. Burstall, of the University of Birmingham.

During the annual employees' tea and social gathering in connection with the Bradford Corporation Chemical Works, at Frizinghall, a presentation was made to Mr. Wilfrid Wyld, the Manager, who is leaving shortly to take up another appointment. Mr. John Walmsley, on behalf of the whole staff, handed Mr. Wyld a handsome travelling case, and to Mrs. Wyld a teaurn suitably inscribed. Expression was given to the high esteem and regard in which Mr. Wyld had been held by the staff; and Mr. Wyld briefly replied.

We learn from "Engineering" that there has been discussion as to utilizing natural gas-fields in St. Maurice County, Canada, for lighting and heating purposes at Montreal. It appears that Three Rivers is now getting gas for manufacturing purposes from this source, at 10d. per 1000 cubic feet; and it is thought that, after allowances have been made for the cost of the piping from St. Barnabe to Montreal, it will be possible to sell gas in the city at a considerably lower rate than is now being paid for it. The chief item of cost would be the laying of pipes; but it is believed that it will be possible to lay the pipes along the surface of the ground throughout the greater portion of the distance. The main problem is the permanency of the supply; and of this the Canadian Coal Gas Company, who possess the right to tap the country for gas and oil, propose to assure themselves as quickly as possible. The pipe-line to Three Rivers is 13½ miles long, and there are some 14 miles of pipes, with 500 connections, in the streets; while the pipe-line to Montreal would have to be 90 miles long.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 49.)

THE course of things on the Stock Exchange last week was curiously variable. It opened with the cheerfulness approaching enthusiasm which characterized the close of the week before; and business grew almost brisk in one or two lines. Prices were on the rise in Consols and the gilt-edged division; Home Rails were quite strong; the variable American was better; and the rest were fair. This was repeated on Tuesday; and thus the year had a bright finish. But then came the New Year's Day interval; and on Thursday things looked very different. Alarmist suggestions from the Continent threatening the peace of the world had a chilling effect; and realizing to secure profits was the order of the day. Friday saw the same operation in full swing; but happily some of the choicer markets held firm. On Saturday, the movement was pretty well stayed; and there was some recovery in the higher class markets. In the Money Market, there was a large demand up to the end of the year at very firm rates; and even after the turn of the year the firmness was fairly maintained. The course of discount was steadily easier. The happy event of the reduction of the Bank rate to 6 per cent. from the 7 per cent. fixed just two months ago took place on Thursday. Business in the Gas Market was fairly active, and the tendency was favourable. In Gaslight and Coke issues, the ordinary was very strong—especially after Friday's announcement of the reduced price of gas. Transactions ranged from 95 to 96¾ (a rise of 1½ in the quotation); the closing figures being the best of the week. In the secured issues, the maximum marked 86⅝ and 87, the preference 103½, and the debenture 81½. South Metropolitan also gained 1, with transactions marked at from 120½ to 123. The debenture was done at 82¼ and 83. Commercials were more active. The 4 per cent. marked from 103 to 105; and the 3½ per cent. from 99 to 101. In the Suburban and Provincial group, British changed hands at 40-40½, South Suburban at 114½, ditto preference at 118, ditto debenture at 121, Wandsworth debenture at 75½ and 76 *ex div.*, and West Ham at 100½. In the Continental Companies, Imperial rose 2½, marking from 170½ to 174. European fully-paid marked 23, and ditto part-paid 16⅞. Tuscan fetched 10⅝ *ex div.* Among the undertakings of the remoter world, Buenos Ayres was done at 11 and 11⅛, Primitiva preference at 5 1/16, ditto debenture at 93½ and 93¾, San Paulo at 13⅜, and River Plate was very active at from 13⅜ to 13 7/16.

According to the usual custom, we append a table showing the closing prices at the end of 1906 and those of 1907, with the respective gains and losses in value. As might be expected, prices, almost without exception, are lower; the Gas Market, in common with the rest, having suffered from the severe monetary stringency of the last two months.

GAS COMPANIES.	Prices on Dec. 30, 1906.	Prices on Dec. 31, 1907.	Gain or Loss.
Alliance and Dublin, 10 per cent.	20—21	19—20	−1
Do. 7 per cent.	14—15	13—14	−1
Bombay, Limited	6½—7	6¼—6⅝	−⅛
Do. New, £4 paid	5—5⅛	4⅞—5	−⅛
Bournemouth, 10 per cent.	28—29	27½—28½	−½
Do. B. 7 per cent.	17—17⅛	16¼—17	−⅛
Do. Preference 6 per cent.	15—16	14⅝—15½	−½
Brentford, Consolidated	260—265	243—248	−17
Do. New	200—205	181—186	−19
Do. 5 per cent. Preference	120—125	115—120	−5
Do. 4 per cent. Debenture Stock	101—104	98—101	−3
Brighton and Hove, Original	230—235	200—210	−27½
Do. A Ordinary Stock	163—168	153—158	−10
British	41—43	40—41	−1½
Bromley, Ordinary 5 per cent. A	121—125	117—120	−4½
Do. 3½ per cent. B	91—94	87—90	−4
Buenos Ayres (New), Limited	11½—12	10⅜—11¼	−¾
Do. 4 per cent. Debenture	94—96	89—91	−5
Cagliari, Limited	24—26	26—27	+1¼
Cape Town and District, Limited	14—15	6—8	−7½
Do. 4½ per cent. Preference	9½—10	7—9	−1½
Do. 6 per cent. 1st Mort.	50—52	48—50	−2
Do. 4½ per cent. Deb. Stock	96—98	92—94	−4
Chester 5 per cent. Ordinafy	108½—110½	108—110	−½
Commercial, 4 per cent. Stock	110—113	100—103	−9
Do. 3½ per cent. do.	107—110	68—103	−8
Do. 3 per cent. Debenture Stock	83—85	80—82	−3
Continental Union, Limited	124—127	106—111	−17
Do. 7 per cent. Preference	138—143	135—140	−3
Derby, Consolidated Stock	122—124	122—123	−½
,, Debenture Stock	105—107	103—105	−2
European, Limited	24½—25½	22½—23½	−2
Do. £7 10s. paid	18—19	16¾—17½	−1½
Gaslight and Coke, 4 per cent. Ordinary	98¼—99½	95—96	−3½
Do. 3½ per cent. maximum	88—90	86—88	−2
Do. 4 per cent. Con. Pref.	107—110	102—105	−5
Do. 3 per cent. Con. Deb.	84—86	81—83	−3
Hastings and St. Leonards, 3½ per cent.	98—103	93—98	−5
Do. 5 per cent.	118—121	114—117	−4
Hongkong and China, Limited	19½—20⅜	19—20	−½
Imperial Continental	177—180	169—171	−8½
Do. 3½ per cent. Deb. Red.	96—97	91—93	−4
Lea Bridge Ordinary, 5 per cent.	120—125	110—120	−7½
Liverpool United A	229—231	220—222	−9
Do. B	167½—168½	158—160	−9
Do. Deb. Stock	110—112	106—108	−4
Maidstone, 5 per cent.	145—150	140—145	−5
Malta and Mediterranean, Limited	4¼—4⅜	4—4½	−⅛
Metropolitan of Melbourne, 5 p. c. Deb.	101—103	99—101	−2
Do. Do. 4½ p. c. Deb.	101—103	100—102	−1
Monte Video, Limited	11½—12⅜	10½—11½	−1
Newcastle and Gateshead, Consolidated	111⅝—112⅜	105—107	−6
Do. 3½ p. c. Deb. Stk.	98—99	86—88	−11½
North Middlesex, 10 per cent.	20—21	19½—20½	−½
Do. 7 per cent.	13¾—14½	13—14	−⅝
Oriental, Limited	150—155	136—138	−15½
Ottoman, Limited	5⅝—6⅛	6—6½	+⅛

GAS COMPANIES.	Prices on Dec. 30, 1906.	Prices on Dec 31, 1907.	Gain or Loss.
Primitiva, Ordinary	7¼—7⅜	6⅞—7	−⅜
Do. 5 per cent. Preference	5⅛—5⅜	4⅝—5⅛	−⅜
Do. 4 per cent. Deb. Stock	94—96	92—94	−2
River Plate, Ordinary	12⅛—12⅜	13—13⅛	+⅝
Do. 4 per cent. Deb. Stock	95—97	90—92	−5
San Paulo, Limited	13¼—13⅜	13—13⅛	−¼
Do. 5 per cent. Deb. Stock	49—51	48—50	−1
Sheffield, A.	246—248	244—246	−2
Do. B.	246—248	244—246	−2
Do. C.	246—248	244—246	−2
South African	15⅛—16⅛	14⅛—15⅛	−1
South Metropolitan, 4 per cent. Ordinary	128—130	119—122	−8½
Do. 3 per cent. Deb. Stk.	85—87	81—83	−4
South Shields Consolidated Stock	156—158	154—156	−2
South Suburban, Ordinary 5 per cent. Stk.	123—126	114—117	−9
Do. 5 per cent. Preference Stk.	123—126	117—120	−6
Do. 5 per cent. Debenture Stk.	128—133	120—125	−8
Southampton, Ordinary	105—110	104—109	−1
Tottenham and Edmonton, A 5 per cent.	127—130	120—123	−7
Do. B 3½ per cent.	104—106	100—103	−3½
Do. 4 p.c. Deb. Stk.	101—103	97—100	−3½
Tuscan, Limited	10½—11	10⅛—10⅜	−⅛
Do. 5 per cent. Deb. Red.	104—106	100—102	−4
Tynemouth, 5 per cent. maximum	106—108	107—109	+1
Wandsworth and Putney, B 3½ per cent	140—145	128—133	− 2
Do. 3 p.c. Deb. Stk.	79—82	73—78	−5
West Ham, 5 per cent. Ordinary	102—104	100—103	−1½
Do. 5 per cent. Preference	120—123	118—120	−2½
Do. 4 per cent. Debenture Stock	101—104	99—102	−2

ELECTRIC LIGHTING MEMORANDA.

A Review of the Past Year.

No extraordinary events marked the progress of the electrical industry last year. From its birth it has ever had a checkered career; so that a continuation of what was previously common experience enables the use of the above opening sentence. Strenuous competition has continued the year through; and it is this strenuous competition, and the difficulties of the electrical industry in making satisfactory headway in consequence of it and the gas industry's superior commercial position, that make the outlook for electricians a somewhat sombre one. But in addition to the difficulties of competition, financial mischief is being worked within the electrical industry, by the cultivation of systems of administration that are peculiar in the commercial world. We have seen during the year the results of this peculiar administration among both company and municipal undertakings. Look at the reduced profits in the accounts of the companies published early in the year; look at the unhealthy condition divulged in the case of several municipal undertakings. And what is the meaning of these things? Are they the product of good or of bad financial administration? The accounts of the Metropolitan Electricity Companies exhibited a dwindling of profits; and this was easily traceable not to a diminution in the consumption of electricity, but to the average lower price obtained from its sale. And this lower average price was the result not, generally speaking, of reductions in price to the ordinary lighting consumer, but of ridiculously reduced rates for electricity used for power, heating, and public lighting, no matter what the character of the load.

Of this the St. James's and Pall Mall Company—supplying one of the best parts of London—was not a solitary example. With them, the accounts published during the year showed, income had diminished; the dividend had fallen to 10 per cent. (a drop from 14½ per cent.); the normal rate of increase in consumption had not been maintained; the price of electricity for power and radiators had been lowered to 1d. per unit, and this had brought down the average price from 3·42d. to 3·21d. As the charges for lighting were 6d. to 4d. per unit, the average price of 3·21d. shows that the lighting consumers must suffer considerably through the extreme lowness of the charges to other consumers. The decline of 0·21d. on the whole output, the Chairman of the Company told the shareholders, represented in 1906 no less than £7600, of which the increased output only recouped £4000. It is a peculiar method of commercial administration that produces a bigger business with less profit than the former smaller business. But it is the kind of thing that is going on throughout the electrical industry. This all comes about from a speculative determination of charges and the application of load-factor estimates that rarely work out in every-day experience. But even with the very common "penny per unit" charge for electricity for cooking and heating and motive power, the rate of increase in these directions is greatly deplored by electricians, though every increase reduces their profits, and their ability to pay larger dividends. They sadly want to be protected against themselves. From the experience of the St. James's and Pall Mall and other Companies, a continued outrunning of the line of increase of the cheap electricity and the slow movement of the line of increase for the dearer electricity must have the effect of reducing the average revenue per unit—the difference between the charges being so great. Consequently, the position is likely to get worse instead of better. With, in the case adopted for illustration, increased business representing only £4000, to set against a loss of £7600 through the reduction of the average revenue per unit, suggests that it would not want very many years of this sort of thing to entirely wipe out profits.

The position must be regarded as the more serious when it is remembered that in the cooking and heating and the power business, it cannot be said that there has been any phenomenal growth in London. Cooking by electricity is sluggard in more ways than one; and what else can be expected when (quite apart from the initial and maintenance costs, and want of reliability and rapidity in operation) from various sources we are informed, from actual trials, that comparatively dear gas is one-third to one-half cheaper than electricity, and that electricity is even dearer than coal for the purpose, and as to electrical heating, the slow advance, even with current at 1d. per unit, is due to cost and inefficiency. The "Electrical Times" during the year spoke as to the foolishness of talking of radiators costing 1d. an hour when special wiring, plugs, and meters are taken into account; the "Electrical Review" warned station engineers against repeating the original error of asserting an equality with gas-stoves on the price-for-price consumption; Mr. B. Sankey, in the "Electrical Times," called attention to the price of radiators; and their slow heating power was also complained of in one publication during the year. Again, we had Sir William Preece, at a company meeting, bemoaning the slow rate of power development, and putting it all down to the inertia of the old-fashioned engineer, who has not learned the value of scrapping. Separating the cause from the fact as to slow increase in power development, what Sir William finds in the latter respect is only what is experienced in many other places; for notwithstanding the chirpings of some electricians as to what they are doing in this way, the Electrical Engineer in Liverpool has announced that he has great difficulty, even with low prices, in attracting the long-hour and constant consumer, and the same is the experience of Mr. T. Roles, the City Electrical Engineer of Bradford, who has declared that the price of electricity for power purposes would have to come down "considerably below" 1½d. per unit before having any suasive effect. Unremunerative short-hour and intermittent loads, which are not particularly wanted by electricians, are not at all troublesome to get. But it is not alone the question of price that power users look at. Reliability of both motor and energy supply are other points. Something will be said about failures presently; but in the last annual report of the Chief Inspector of the British Engine, Boiler, and Electrical Insurance Company, Limited, it was stated that, during the year under review, the rate of breakdowns of insured motors was 1 in 8·2. However, the point of importance is that, though complaint is made that this business is so hard to get, at the price at which it is being obtained, it is having a somewhat gloomy effect on the profits and prospects of undertakings. We may soon learn something more about these matters so far as London is concerned, as, at the instance of the President of the Board of Trade, a return was ordered in August last of the number of units of electricity delivered, and the average price charged for power and heating and for private and public lighting during the then last completed year. By the way, electric power companies have not been doing anything very noticeable; except that the South Wales Company have commenced the process of dissolution by the sale of certain of their effects. Compared with two or three years ago, there has been a great depreciation of the market value of the shares of power and ordinary electric supply companies.

Much the same causes that have affected companies have operated against municipal undertakings. There are some things, such as the increased price of coal, that cannot be helped; but the peculiarity of administration to which reference has been made seems to run through the greater part of the electrical family. The instances of bad financial administration on the part of municipalities in connection with electricity supply that received prominence during the year are too numerous to cite. But look at the loss by the Brighton Corporation of over £10,000 on a year's trading; to the loss by West Ham through over-straining (by imprudent reductions in price) the recuperative capacity of the concern; to the loss on the Monmouth electricity undertaking, which caused an amount of local consternation; to the troubles at Woolwich, Wigan, Rhyl, Southend, and other places through dissatisfaction with the general condition of things; and to the dilemma in which the Newport (Mon.) Corporation were placed in consequence of the Local Government Board declining a loan while an adverse balance remained on the revenue account. The case of Woolwich, as the new Borough Council were fully satisfied, on the report of Sir Alexander Kennedy, was a very bad one. They found their predecessors had bequeathed them many things—among others an overdraft at the bankers amounting to about £60,000, of which £42,000 was on account of electric lighting. There was no relaxation during the year of the efforts of the Local Government Board to expose the flagitious management of municipal electricity undertakings where ground existed for such exposure. Some municipalities apparently harbour the belief that civic life begins and ends in electricity undertakings, and that their management should not be questioned; and there was again much railing during the year against the Board, for showing shrewdness in conducting their inquiries. The Board, however, have a duty to perform to the ratepayers; and in performing that duty, they cannot turn a blind eye to maladministration. At Liverpool, Halifax, Watford, and Surbition, among other places financial delinquency was found. At different places authorized capital expenditure had been exceeded, capital sanctioned for one purpose had been spent for another, from plans on which loans had been granted there had been departure, and at Watford and Surbiton, cables had been laid in roads from which it was impossible to expect remunerative revenue. Wasteful expenditure on public lighting was also found, and advice was given here and there—much to the distress of our contemporaries—to look carefully

into the comparative expenditure of electric and modern incandescent gas lighting. The advice was ponderously spoken of as "retrograde." In addition to Newport (Mon.), a loan was withheld from Dover, pending greater satisfaction on certain points; and a loan for a new site for a central station at Willesden was declined, on the ground that there was no proof that it would be wanted. The Departmental Committee, appointed by Mr. John Burns, largely owing to the exposures in connection with municipal trading in electricity, made their report, with many suggestions, which it is hoped will prove effectual in bringing about honest accountancy and dealings with the finance of municipal electricity departments. The provision of adequate depreciation was pointed to as a necessity in several cases; and at Halifax, the Electrical Engineer predicted a future financial disaster if ample consideration was not given to this matter. In our review of the published annual accounts of municipal electricity undertakings, many deficits and narrow profits (the cost of coal being one of the depressing factors) were exposed, notwithstanding a benevolent consideration in respect of rates, establishment charges, and revenue from public lighting. Heavy receipts from the lighting of a small length of street are not the only means by which the revenue of municipal electricity undertakings is swollen. Public institutions are laid under contribution. During the year extravagance was divulged at the Cardiff Mental Hospital and the Hammersmith Workhouse. At Plymouth, the Special Purposes Committee of the Guardians were favourable to the adoption of incandescent gas lighting for the workhouse; but it shows what local government has come to when a majority of the Guardians thought that, as the town had embarked on the electricity business, it was their duty to support it. A bigger misconception was never made between duty to the large body of ratepayers and duty to electricity undertakings. Complaint was made that, at the Brownlow Hill Workhouse (Liverpool), the consumption of electricity had been greater than had been predicted. The Electrical Contractors' Association prosecuted their campaign against municipal wiring and trading in fittings; and the result is a model clause for future application in Bills confining municipalities to the spending of money in this direction through contractors. The wiring business has proved so unprofitable in many places that it has largely lost favour—among the undertakings that have now discontinued the system being Woolwich.

There was very little doing in Parliament during the session in connection with ordinary electricity supply. The London County Council Bill was by far the biggest measure for consideration. This was the Bill—successor to more ambitious proposals of the old Progressive-Socialist combine—by which the Council sought to obtain powers for bulk and power supply which they could transfer to a company. Their idea was to place the financial responsibility on private shoulders instead of on the ratepayers, and yet to retain certain supervisory rights. But the change, complying with the decisive vote of ratepaying London, did not suit the present rulers in the House of Commons, who wanted no interference with their policy of giving plenty of rein to municipalization while in power. However, the County Council were not disturbed by the action of Parliament, but rather congratulated themselves that (only!) £8500 was spent on the measure, instead of the £18,000 for which provision had been made in the estimates. There was nothing specially interesting to us about other legislative work associated with electricity supply. Even the subject of the greater protection of pipes against electrolysis was pushed into the background; the attitude of the Board of Trade and the Lord Chairman in the matter making it impossible to hope for any present success. The only thing that can be done is to keep the subject alive by sustained agitation. The Metropolitan Water Board during the session secured a protecting clause in the House of Commons; but it came under the searching eye of the Lord Chairman, and the clause fell a victim to his mighty pen. The general subject of electrolysis was treated upon in an account of investigations laid before the American Institute of Electrical Engineers; and therein it was stated that alternating currents are less offensively active in this regard than direct currents.

In the realm of public lighting, interest has been kept very much alive during the year on account of the introduction here and there of flame arc lamps for lighting main thoroughfares. The Oxford Street lighting was a particularly noteworthy event, as electricians are making the most of it as a piece of show illumination; and now there are the City trials from which great things are expected. About both of these, we have given much information lately. The Oxford Street lighting is being done at £20 13s. 5d. per lamp, and the City (Cannon Street) lighting at £17 10s. per lamp; but the Oxford Street price includes nothing on account of capital charges, and the Cannon Street price, it is quite easy to show, is not being done at a profitable figure. In Cannon Street 11-ampere flame arcs are fixed; and if they are in use for (taking round figures) 4000 hours a year, their running expenses cannot amount to much less than £20 a year each. In a paper before the Birmingham Section of the Institution of Electrical Engineers, Mr. A. Lindsay Forster gave the cost of running four 9-ampere flame arc lamps for 1000 hours (which is the same thing as one lamp for 4000 hours) at £21 11s. 4d.—made up of 2000 units at 1½d. per unit, £12 10s.; chemical carbons, £4 10s.; 260 trims, £2 3s. 4d.; repairs, £2 8s. The 1½d. per unit is low. Although in Cannon Street magazine lamps are used, being centrally suspended, the work of trimming and attention is laborious, and so the price given by Mr. Forster for trimming will not be far wrong; and being magazine lamps, their repair would amount to more than the ordinary type of lamp. Therefore it may be taken that the offer of £17 10s. for 11-ampere lamps has been made in order that the horn of the electricians in the City may again be exalted. It is certainly not a commercial transaction to supply these lamps at £17 10s. a year. The central wire suspension of the lamps has been much criticized, as has also been the line of central standards in Oxford Street. The latter system is objected to by the authorities; and we are not likely to see its extension in London. Wire suspension, too, can only be applied (we will not say the system is a proper one) in comparatively narrow thoroughfares. The figures for the Oxford Street lighting were dealt with in the "JOURNAL" for Feb. 12 and Dec. 31. However, with the running experience of these lamps, and of the expense and troubles they bring in their train, embracing rapid depreciation, there is not likely to be any extensive adoption of them for street lighting. Their glare and flickering and the concentrated illumination they afford (unsteady though that illumination is) necessitate their raising high in the air, and a large amount of light is thus dissipated where it is not wanted. Sharp shadows are thrown; and rapid is the descent in the value of illumination beyond the immediate vicinity of the lamps. Streets are not theatre stages, or places where fine needlework has to be done; and therefore it is waste of money to overlight them, though far be it from us to suggest that they should not be efficiently lighted. There was plenty of complaint during the year as to the indifferent character of public electric lighting; and in heavy fogs even the flame arc lamps, as a writer in the "Bystander" testified recently ("JOURNAL," Dec. 17, p. 851), are next to useless as street illuminants during those times, and times when they are most needed. We remember, too, what the marine expert of the White Star Line said as to the electric light at the Lizard lighthouse. But not only in respect of inefficiency, but in respect of high cost has there also been complaint during the year. This public lighting question is a big one, and much could be said upon it; but we must refrain in this review of the year. While speaking of flame arc lamps, however, it may be mentioned that a little experience has gone a long way to convince shopkeepers that there is not much business in dazzling the eyes of would-be customers, but a great deal of unremunerative expense.

Carbon filament lamps are yet a long way from extinction; but during the year they have, as a class, received some hard knocks for maintaining a bad reputation for inconstancy and rapid depreciation in performance. The poor things are not altogether to blame; variable pressures accounting for at any rate part of the trouble. The Engineering Standards Committee issued, in the fore part of the year, a specification for carbon filaments; but improved result is not yet found in the lamps bought over the counter. However, the new metallic filament lamps next to the flame-arc lamps are the things of the day; but as yet the 1 watt per candle lamp that will run satisfactorily on a 200 to 250 volt supply has not been discovered, and the physical difficulties in the way appear to be insuperable. When the new metallic filaments first put in an appearance, great fear and trembling were seen in the electrical industry; and the phantom of ruin it was fancied was standing at the door of every supply undertaking. But high supply voltages have saved the undertakings from revenue sacrifices to the metallic filament. The lamps cannot be run singly on the voltages in this country; and so where one carbon filament lamp existed before, if more light is wanted, the electrical engineer can group four or five of the low-voltage metallic filament lamps. In this way he does not lose much (if anything) in consumption, the consumer pays the same as before for electricity (but more for lamp installation and renewals), in return for which the consumer has more illumination. The manufacturers of the Osram lamp have been busy advertising it, and making comparisons with gas lighting that will not stand examination, and certainly will not permit them to accept a challenge issued by the Welsbach Company, the winning of which would be a much more valuable advertisement than some of the assertions they are at present making, but cannot substantiate. The subject is one to which we shall be returning shortly.

In view of the higher cost of electricity compared with gas, efforts were not relaxed during the year to devise new systems of charging for electricity, and complicating the relations between buyers and sellers. But skill in creating something promising has been exhausted in this direction; and as new charging systems are further produced, the sillier they get. At Norwich, a proposal was made of a fixed charge per annum of 12 per cent. on the net assessment of premises supplied (which was to include meter-rent), and, in addition, 1d. per unit used. Apparently, in order to obtain relief from the stress of the peak-load, Edinburgh and Bradford put forward most humorous proposals. It was gravely proposed in Edinburgh that consumers, who refrained from using the electric light between 4 and 7 p.m. in the winter months, should only be charged 2d. per unit for electricity; and at Bradford, the suggestion was made that supplies for power and heating should be offered at the flat-rate of ¾d. per unit, provided no current was taken from the mains between half an hour before sunset and 7.30 p.m.! Several papers and articles appeared during the year advocating greater attention to the question of illumination, with the view of reducing the points of lighting, and thus enabling cost to be brought nearly to an equality with the superior position of incandescent gas lighting in this respect. Speculative electricity charges were the subject of papers at the annual meeting of the Incorporated Municipal

Electrical Association; but the undertakings that have not adopted speculative electricity charges, study of load-factors notwithstanding, are few and far between. We fell foul of one of our contemporaries during the year over the question of the relative accuracy and general good conduct of gas and electricity meters. The paper in question was silent over the reply, in which attention was drawn to the compulsory stamping, after rigorous official testings, of every gas-meter (as provided by the Sales of Gas Act), before fixing on a consumer's premises; and we compared the provisions of the Act with the milk-and-water optional provisions of the Electric Light Clauses Act of 1899. The electrical industry has a strong aversion to official testings. The undertakings affected offered resistance to proposals of the London County Council to establish stations for testing pressure, &c., and the conditions and expenses attaching to the testing of meters were also the subject of criticism.

The electric light has sustained its reputation for inconstancy during the year. The year opened badly, with the failures in Oxford Street and South London. In connection with the former, "Punch" suggested to the Marylebone Borough Council that they might make a handsome profit by trading in candles; and in connection with the latter, the Gas Companies in the area of the South Metropolitan Electric Supply Company did an excellent business in restoring gas. Paris (through a strike) and Berlin also had experiences of sudden deprivation of electricity supply—in Berlin in the main parts of the city, and later on in the suburban district of Charlottenburg. Among other towns that experienced some inconvenience from failures were Barnes, Brighton, Cardiff, Colchester, Felixstowe, Huddersfield, Hull, Manchester, Oldham, Sutton, Tunbridge Wells, Worcester, and Wycombe; and in public buildings and places of worship, the Queen's Theatre and Royal Exchange, Manchester, the Edinburgh Court of Session, Old Windsor Church, the Oldham United Methodist Church, Pontypool Market, and the King's Theatre, Hammersmith.

Electrically generated fires again supplied subject-matter for controversy; and the much-lauded safety of electricity as an illuminant was greatly damaged by happenings which our electrical friends passed over as lightly as they decently could. The report for 1906 of the Chief Officer of the London Fire Brigade showed that fires known to have been caused by electricity numbered 105, while 405 were due to gas. But as we indicated at the time, both in the "JOURNAL" and in one of the "Illuminating Truths" leaflets, taking the number of consumers of the respective illuminating agents, the proportion of fires to consumers was greater for electricity than for gas. The Chief Officer added to his report that there were 332 more fires in 1906 than in the preceding year; and among the causes to which he ascribed this were defective electric currents, which produced 100 fires against 70 in 1905. Dr. Waldo, the City Coroner, in inquiring into the Wood Street fire (at which damage amounting to £80,000 was occasioned), stated that his experience led him to entertain the suspicion that many fires the cause of which could not be conclusively traced were due to electricity. Among the fires of the year were those at Camden Church, Camberwell; at a jeweller's in St. Paul's Churchyard; at the Blackheath (Staffs.) Bolt and Screw Works; at Gamage's; at the premises of Messrs. A. & E. Walter, Limited, Finsbury (damage about £6000); at the motor show in the Grand Palais, Paris; during an entertainment at the Edmonton Town Hall; at (as reported in the "Manchester Guardian") one of the branches of the Bradford Dyers' Association; and at the South Ealing electricity works. Mr. T. S. Harman recovered damages from the Shoreditch Borough Council for a fire caused by an electric motor at his works. The experience at a Blackburn Church, of lightning causing the fusing of an electric light wire, was repeated at a drapery establishment at Hereford. Herr Schäfer's interesting studies of the relative fire-producing energy of electricity and gas in Germany were instructive contributions to the general subject. The Institution of Electrical Engineers issued during the year their revised wiring rules; and the Home Office circulated a new draft of rules for the installation and use of electricity in factories. Nevertheless, in professional circles, there is still turmoil over the question of the safest system of wiring. Every method of running wires has its adherents and its opponents; every method is credited with advantages and dangers. Regarding flexible wiring, there was acknowledgment on the part of an electrical contemporary that a big fire in a South London drapery house was due to a damaged flex.; and it is known conclusively that the fatal accident in the purifier-house at the Dublin Gas-Works was caused by a defective flexible wire. In the "Electrical Review," a timely article appeared, by Mr. Frank Broadbent, in which he emphatically said the need for careful inspection of electrical work was now more than ever necessary. Following fires, mention may be appropriately made of the annual report of Mr. G. S. Ram, Chief Inspector of Factories, in which it was seen that the electrical accidents in engineering works during the year under his review numbered 190 compared with 120 the previous twelvemonth. Explosions in electric light culverts and boxes appear to be diminishing, or perhaps people are getting so accustomed to them that less public alarm is occasioned by them, or perhaps knowing what they do now electricians are not saying so much about these occurrences. In the course of the year, a report from Aberdeen, and a paper by Dr. Bassett, read before the Liverpool Section of the Society of Chemical Industry, were contributions to what now has been accepted knowledge for some years, that electricity distribution systems are capable of generating explosive mixtures and fire them on their own account, without the assistance of any coal gas.

There are two or three miscellaneous matters over which a few gliding remarks may be made as being features of discussion during the year. Electricians, or certain of them, are paying greater attention to photometry than formerly; but they are not content with the developments in the science produced by long experience. They are trying to strike out new lines for themselves. We have heard from Mr. C. C. Paterson, Mr. Haydn Harrison, Mr. Lancelot Wild, and others on the subject; and it is amusing to hear these striplings in photometric work adopting what their elders know to be fallacies, or introducing error and inaccuracy into what should be very exact and scientific procedure. Comment has been freely made upon their work during the year; but their proclamations have not attracted more than transient interest.

Turning from this subject to the British electrical manufacturing industry, its condition at the beginning of the year was described by one of our contemporaries as most precarious; and at the end of the year, nothing much better can be said of it. The shareholders of the Westinghouse Company, for example, find themselves to-day heavy sufferers; and there are other concerns that have got one foot into the winding-up stage, and the other will soon be there if there is not speedy relief. One bright ray is that copper has fallen from £110 to £60 per ton. But this is of little consequence when work is stagnant; and the manufacturing and contracting firms are hovering over every little job like a swarm of hawks, glad to get work if only to keep their shops open, and present to the world a superficially active existence.

Reverting to the competition of electricity with gas, propaganda work is being vigorously prosecuted by electrical undertakings, though not completely in the most honourable way. In the course of the year, the leaflets of station engineers have been criticized in the "Memoranda," and their fiction exposed. They make statements in the leaflets in vague fashion; to facts and figures they will rarely come. Even in our contemporaries, fair-dealing is not an inflexible virtue. Distorted and dismembered quotation has been made from our columns; cost comparisons between electric arc lamps and common incandescent burners are noticed; and ignorance of gas matters frequently causes amusement by the assumed authoritative style in which it is presented—ignorance which many a gas consumer could expose from his own experience. However, with it all, the gas industry progresses and prospers; and active competition for business will maintain the supremacy that has been so long enjoyed by the gas industry over the electricity supply industry.

Manufacture of Large Gas-Engines in America.—As an indication of the rapid development in the manufacture of large gas-engines and the importance of the field occupied by this type of prime-mover, "Engineering Record" says it is of interest to note that another manufacturer of large Corliss steam-engines has actively taken up the production of gas-engines. The Wisconsin Engine Company, who have works at Corliss (Wis.), are building gas-engines for all services, in sizes from 400 to 5000 B.H.P. The engines utilize natural, producer, coke-oven, or blast-furnace gas in the Otto cycle (four-cycle), and are of the horizontal tandem and twin-tandem double-acting type. The Company control the Sargent patents for internal combustion engines, and have employed Mr. C. E. Sargent as the Engineer of their gas-engine department. The gas-engines built by the Wisconsin Engine Company bear some of the distinctive features of their large Corliss engines, and utilize in design most of the Sargent patents.

Blast-Furnace and Coke-Oven Gas for Motive Power.—In a paper contributed to the Association des Ingénieurs de l'Ecole de Liége, M. Greiner treats of the use of blast-furnace and coke-oven gases for the production of motive power. According to an abstract of the paper in "Engineering," a modern coke-oven will produce 8500 cubic feet of gas per ton of coal coked. Of this, about 35 per cent., or 3000 cubic feet per ton of coal converted, is available for the production of power; the remainder being required to heat the ovens and for other purposes. The gas contains from 25 to 35 per cent. of methane, and from 50 to 55 per cent. of hydrogen; its calorific value per cubic foot being never less than 390 B.Th.U., and often as much as 500 B.Th.U. Coking coal contains from 16 to 30 per cent. of volatile matter. With the lower figure, the yield of bye-products will be about 16 lbs. of sulphate of ammonia and 40 lbs. of tar; and the coke produced will amount to nearly 17 cwt. per ton of coal converted. With the richer coal, containing 30 per cent. of volatile matter, the yield of coke will be reduced to 13 cwt.; but there will be 37 lbs. of sulphate of ammonia and 130 lbs. of tar. In the case of the blast-furnace, the gas available amounts to about 160,000 cubic feet per ton of coke consumed; and the gas contains from 21 to 26 per cent. of carbon monoxide and only small percentages of hydrogen and methane. Its calorific value is about 100 to 110 B.Th.U. per cubic foot. The hot stoves require about 45 per cent. of the total production of gas; and if steam is used for the blowing-engines and other accessories, almost the whole of the gas remaining will be required under the boilers. With gas-driven blowing-engines, however, and electrically-operated accessory machinery, only 15 to 20 per cent. of the total gas produced will be needed for driving them—leaving some 40 per cent. available for other purposes.

THE GAS REFEREES' NOTIFICATION FOR 1908.

THE Notification of the Metropolitan Gas Referees for the current year, which was issued last Wednesday, differs in only a few respects from its immediate predecessor; and the chief alterations made may be readily recognized, as they are printed in italics, and the fact is mentioned in a foot-note on the first page. In the directions for testing (p. 8), it is stated that the reading on the photometric scale is to be made four times, and the mean of the results taken "to the second decimal place." The mean of the four readings is to be multiplied by the number of seconds in the time recorded and by the aerorthometer reading and divided by 120. The quotient is the illuminating power, "which should be stated to the nearest hundredth of a candle." In the section on "Testings with the Standard Flat-Flame Burner" (also on p. 8), the Referees specify that the burner shall be a "Bray's burner marked $\frac{G}{L}$ 5 Ft. $\frac{15}{10}$, and having a slit 0·028 inch wide." In the directions as to testing the calorific power of gas (p. 11), the examiner is to make his observations at the end of an interval of not less than "30" minutes after the apparatus has been prepared. In Appendix D, the above-mentioned burner is described in detail on p. 25; and on the same page there is a paragraph specifying that "each testing-place is provided with a box containing thickness gauges;" and "the gas examiner must reject any burner the slit of which admits the 0·029 inch gauge, or which does not admit the 0·027 inch gauge." Lower down on the same page, in the remarks on the slide, connecting-rod, and photometric scale, it is specified that "the slide should occasionally be wiped with a duster and lubricated with a little vaseline." In the observations on the dark screens, mirrors, and measuring-rod, it is pointed out (p. 29), with reference to the third mirror, which is arranged to throw light on the photometric scale, that "the gas examiner should avoid seeing the scale while he is making a setting." Lower down, in the paragraph on the verification of the correct position of the photoped and the burners, it is stated that when the rod is in position upon "the argand burner set at the 10-candle distance by the scale, or upon the 10-candle lamp," and the long end is moved gradually round towards the photoped, the point should just come in contact with the paper under the clamping-plate at the middle point.

GAS BILLS FOR 1908.

[FIRST ARTICLE.]

COMMENCING to-day the review of the Gas Bills introduced for promotion in the coming session of Parliament, we deal first with the measures proposing the incorporation of new or established limited companies.

Under a series of Provisional Orders passed in 1871, 1878, 1895, and 1904, the Bognor Gaslight and Coke Company are carrying on their operations. The capital (including borrowing powers) authorized by these Orders is £49,333, of which £31,813 has been raised and expended. But in view of the increased and increasing demand for gas in the area supplied, further powers are required. The parish of Pagham adjoins the Company's area; and up to the boundary of the parish, they are supplying gas. The Local Authority are now requesting a supply; and therefore the Company ask for a repeal of so much of section 6 of the Petersfield and Selsey Gas Act of 1901 as authorizes the supply of gas by the Petersfield and Selsey Gas Company to such parish. The nearest works of the latter Company are many miles distant from Pagham; and from the unproductive nature of the intervening district, it is submitted that it is not possible for that Company to afford a supply. The extended limits defined as the area of supply will embrace Bognor, Bersted, Felpham, Pagham, Aldingbourne, Eastergate, Barnham, and Yapton. The capital suggested is £75,000 consolidated ordinary stock, bearing a standard dividend of 5 per cent. Of this amount it is proposed that £39,000 be the original, and £36,000 the additional capital. The existing holders of £5 shares the maximum dividend on which is 10 per cent., it is intended shall receive for every share £10 nominal value consolidated ordinary stock; and those holding £5 shares on which the maximum dividend is 7 per cent., for every share £7 of stock. The borrowing powers asked for are £12,900 (including £4000 already borrowed) in respect of the original capital, and £12,000 in respect of the additional capital. Insurance and reserve funds are provided for. In addition to lands in the possession of the Company, they ask for power to purchase up to 5 acres by agreement. The standard price proposed for gas is 4s. 1d. per 1000 cubic feet in Bognor, Felpham, and Bersted, and 4s. 3d. in the other parishes already named. Operating half-yearly, penny variations in price below or above the standard dividend, it is suggested shall carry increases or decreases of the standard dividend by 2s. 6d. per cent. The price payable for public lighting it is intended shall not exceed 3s. 11d. per 1000 cubic feet in Bognor, Felpham, and Bersted, and 4s. 1d. in the other parishes. The model prepayment clauses are inserted. It is proposed that the quality of the gas shall be 14 candles, burned at the rate of 5 cubic feet an hour in a "London" No. 1 argand. The old discount clause of 10 per cent. for prompt payment and 15 per cent. for large consumptions is included in the Bill. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Dublin and Central Ireland Electric Power Company are promoting an interesting Bill, the main object of which is denoted by the title. But in addition to the supply of electrical energy, they propose to manufacture and store power gas, and manufacture, sell, and deal in any bye-products or residuals of power gas; and they contemplate, as recently stated in our editorial columns, using peat as the raw material for the manufacture of the gas required for generating electricity. Consequently they are proposing to acquire bog lands not exceeding an area of 1000 acres. The proposed capital is £450,000, with one-third borrowing powers; but the compulsory supply powers are not to be put into force before £25,000 are subscribed. [*Parliamentary Agents: Messrs. Torr and Co.*]

The East Metropolitan Power Gas Supply Bill is the promotion of the British Coalite Company. In the preamble, the promoters say: "Whereas in the manufacture of coalite . . . gas is procured which could conveniently be supplied by the Company for the purposes, and within the limits, by this Act defined . . . and, whereas such a supply would be of public and local advantage, it is expedient to confer powers upon the Company with respect to such a supply." In the body of the Bill, "power gas" is interpreted "gas for motive or other power, heating, or any other purpose to which gas can be applied, except illumination." The Gas-Works Clauses Act (except section 13, and the provisions with respect to the amount of profit to be received by the undertakers when the gas-works are carried on for their benefit) is to be applied so far as it is not inconsistent with the present measure; and the same with regard to the 1871 Act, except sections 6, 7, 8, 10, 11, 12, and 24 and 37, and the provisions in the schedules. The limits of supply are the boroughs of West Ham, East Ham, Barking Town, and the part of Woolwich on the north side of the River Thames. The Company's lands at Barking are scheduled for the works. The usual provisions as to the laying of mains are incorporated in the Bill; and the Company propose to place themselves under the obligation to supply premises within 100 yards of any power-gas main—providing the owner or occupier of the premises pays for so much of the pipe as may be laid for a greater distance than 30 feet from the power-gas main. It is provided that the owner or occupier shall enter into a binding contract with the Company (if required by them so to do) to take not less than 1 million cubic feet of gas per thirteen weeks, and to continue to receive and pay for a supply of power gas for a period of at least two years, and not to use, or permit the use of, the power gas for the purpose of illumination. The Company are also to be placed under the obligation not to supply power gas to private dwelling-houses. "Unless otherwise agreed between the Company and consumer," the price of power gas having a calorific value of 500 B.Th.U. gross is to be 6d. per 1000 cubic feet, if the quantity taken by the consumer be not less than 1 million cubic feet per quarter; and not exceeding 7d. if the quantity taken by the consumer be less. For power gas having a higher calorific value than 500 B.Th.U. gross, a further 1d. per 1000 cubic feet for each additional 25 B.Th.U. gross may be asked. But provision is to be made by which if at any time it be proved to the satisfaction of the Board of Trade that the price of slack suitable for the purposes of the Coalite Company exceeds 8s. per ton delivered at the works of the Company, then the Board may, by order, authorize an increase in the price of the power gas beyond the previously mentioned maximum by ½d. per 1000 cubic feet for every 1s. by which the price of slack per ton shall exceed 8s. per ton delivered at the Company's works, or by such other proportionate amount as the Board may determine, and for such period as the Board may fix, with power to the Board to extend any such period so long as the excess of price continues. The Board of Trade, too, are to be given power to—at ten-year periods, and on application by the Company or any local authority within the district of supply—revise the maximum prices. Registration of gas supplied is to be by proportional meters. As to penalty clauses, the Company, it is proposed, shall be liable to a penalty not exceeding 40s. per day for failure to supply power gas. If a consumer is found using power gas for the purpose of illumination, it is to be provided that the Company shall forthwith discontinue the supply to such person. Acting in contravention of this section, "the Company shall for every such offence be liable to a penalty not exceeding £20, and to a daily penalty not exceeding £5, and such penalty may be recovered by the authority or company owning the gas undertaking within whose district such contravention occurs." The conditions common to Power Gas Bills as to the gas possessing a distinctive and readily perceptible smell are embodied in the measure; contravention of this subjecting the Company to a fine not exceeding £50. As in recent Acts authorizing the supply of power gas, any regulations hereafter made by the Secretary of State for the Home Department are to apply also in this case. The minimum heating power of the gas supplied is to be 500 B.Th.U. gross; and arrangements for official testing are incorporated in the Bill. The forfeit for deficient thermal value is not to exceed £20; but no penalty is to be incurred if the Court are of opinion that the deficiency of thermal value was produced by circumstances beyond the control of the Company, or was of so slight or unimportant a character as not to materially affect the value of the supply. Following the section as to the provisions of fittings, the Company ask for this authority to make bye-laws: "The Company

may from time to time make, alter, and repeal bye-laws for preventing the abstraction, waste, or misuse of power gas supplied by them, and for preventing any fraudulent or wrongful interference with any fittings, engines, or machinery, or apparatus, or any meters or other instruments, and may attach to the breach of any such bye-laws penalties not exceeding £5 for any single offence; but such bye-laws shall not be of any force until they have received the approval of the Board of Trade." The Company seek liberty to make contracts with local authorities, companies, or persons, supplying or using electricity for the supply of power gas in bulk. A three-lined clause towards the end of the Bill provides: "Nothing in this Act contained shall be construed as entitling the Company to any monopoly or exclusive right to supply power gas." [*Parliamentary Agents: Messrs. Rees and Freres.*]

Greystones and adjoining parishes, in the county of Wicklow, are without a supply of gas; and consequently it is considered expedient that a supply should be afforded. A Company is being formed for the purpose; and those moving in the matter (the names including the well-known ones of George William Anderson, Robert Bruce Anderson, and Thomas Brown Younger) are applying for parliamentary authority. The capital proposed is £20,000 (bearing a standard rate of dividend of 10 per cent.), with one-third borrowing powers. Provision is made for renewals, insurance, and reserve funds. Land is scheduled for the works; and power to purchase by agreement an additional 5 acres is desired. The promoters ask for a standard price for gas of 5s. 6d. per 1000 cubic feet, with the ordinary sliding-scale provisions applying annually. A discounts clause, proposing up to 10 per cent. for prompt payment and 30 per cent. for large consumptions, is incorporated. A prescribed illuminating power for the gas of not less than 12 candles is suggested, tested by the "Metropolitan" No. 2 burner and the Harcourt 10-candle pentane lamp. A purchase clause is inserted in favour of the Rathdown (No. 2) Rural District Council, operative within the next three sessions of Parliament. [*Parliamentary Agents: Messrs. Grahames, Currey, and Spens.*]

It is also stated that there is no adequate supply of gas to and within certain parishes and places in the counties of Glamorgan and Brecknock; and therefore interested persons are moving to secure powers of supply under the title of the Swansea Valley Gas Company. It is also considered expedient to transfer and vest in this Company the undertaking and property existing under the Ystalyfera Gas Order, also certain private gas-works situated at Pontardawe (now in possession of certain persons connected with the Company, and acquired by them under agreement with the owners of the said private works), as well as the right of selling gas in the district now supplied from the existing private gas-works belonging to Messrs. Player, at Clydach. The limits of supply are defined. The capital asked for is £50,000 with one-fourth borrowing powers. Provisions are incorporated regarding the transfer and purchase of the works already referred to. A standard price of gas is proposed of 5s., and the standard dividend of 10 per cent., with the sliding-scale operating half yearly. The Company ask that the prescribed standard illuminating power be 12 candles, tested by the "Metropolitan" No. 2 burner. The ordinary clauses regarding renewals, insurance and reserve funds, and prepayment meter supply are included. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Swinton and Mexborough Gas Company have exhausted the powers given them by their Order of 1872; and consequently they are seeking incorporation and up-to-date statutory powers. Their issued capital amounts to £19,500; and they nave borrowed £6000. The limits defined for the area of supply are the township of Swinton and the parishes of Mexborough and Adwick-upon-Dearne. The capital requested is £59,500, of which £19,500 it is proposed shall represent the original capital, and consist of ordinary "A" and "B" shares, and £40,000 additional capital. This proviso is attached to the capital clause: "Provided always that nothing in this Act shall render the Company liable to deliver a statement or pay stamp duty under section 113 of the Stamp Act, 1891, as extended by section 12 of the Finance Act, 1896, in respect of the original capital." On the "A" and "B" shares, the standard dividends are to be 10 and 7 per cent. respectively, and on the additional capital 7 per cent. on ordinary issues and 6 per cent. on preference. It is intended that new issues of capital shall be offered to consumers and the Company's employees before being put up for sale by auction or tender. The Company ask for power to borrow up to one-third of the capital, including the £6000 already borrowed. In addition to scheduled lands, power is sought to purchase by agreement up to 10 acres. The standard price of gas is proposed at 5s., with the usual sliding-scale clauses. The prepayment meter clauses are the ordinary, excepting that it is contemplated to vary the section referring to the hire of a prepayment meter only, in this way: "The maximum charge for the hire of a prepayment meter without fittings shall be at the rate of 8d. per 1000 cubic feet of gas supplied through such meter, provided that in any case where the maximum charge aforesaid shall not exceed an amount equal to a rate of 10 per cent, on the cost of the meter, the Company shall be entitled, if they think fit, to make a minimum charge not exceeding that amount." The prescribed illuminating power of gas is placed at 14 candles; the "Metropolitan" No. 2 burner and Harcourt's 10-candle pentane lamp being used in testing. Regarding discounts, the Company desire to be allowed the right to make discounts for prompt payment up to 25 per cent., and to large consumers "upon such scale, and subject to such conditions and regulations as may be prescribed by special contract, in writing, between the Company and any of such consumers, provided that all such discounts and rebates shall be of equal amount under like circumstances to all consumers." Provision is made for insurance, reserve, and renewals funds. [*Parliamentary Agents: Messrs. Baker and Co.*]

The Southwell Gas Company, Limited, seek dissolution and reincorporation, with statutory powers. The issued capital is £8250 preference shares of £1 each, and £8250 ordinary shares of £1 each. The Company are proposing to extend the limits of their supply area; parishes bordering their present district being without a supply of gas. The capital sought is £36,500, of which £16,500 will represent the original capital, and £20,000 the additional capital. Of the latter, the right is desired to raise not exceeding £10,000 as preference capital. The usual one-third borrowing powers is required. The standard rates of dividend on the original ordinary capital are proposed at 10 per cent., and 7 per cent. on the additional ordinary capital. The customary insurance, renewals, and reserve funds appear. In addition to the scheduled lands, the Company ask authority to purchase by agreement up to 5 acres. The standard price for gas is placed at 4s. 2d.—the sliding-scale clauses operating on the half-yearly basis. The illuminating power suggested is 14 candles, tested by the modern means. The Company ask for authority to apply for an Electric Lighting Order. [*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, and Co.*]

PERSONAL.

The Cobham Gas Company, who are at the present time increasing their plant, have also appointed a new Manager—Mr. THOMAS, who has for the last fourteen years been engaged at the Woburn Sands (Beds.) Gas-Works.

Mr. ALFRED WILLIAM BROOKES has been appointed Secretary and Accountant to the British Gaslight Company, Limited. Mr. Brookes entered the service of the Company nearly thirty years ago; and, on the death of Mr. F. L. Linging, he succeeded Mr. Chamberlain in the position of Accountant. He will in future fulfil the dual offices of Secretary and Accountant.

We are pleased to find that one of three gentlemen connected with Runcorn who have just been placed upon the Commission of Peace for Cheshire is Mr. J. MASON FRITH, son of Mr. J. R. Frith, the Engineer and Secretary of the Runcorn Gas Company. The new Justice was trained for the gas profession under his father, and was Manager of the Aldershot Gas-Works in the eighties. Seventeen years ago, however, he became associated with Mr. Samuel Taylor, a lime and coal merchant of Runcorn, and is now a member of the firm.

OBITUARY.

Alderman S. FIRTH, J.P., whose death has just taken place, after a few days' illness, at the ripe age of 84, was for some fifteen years Chairman of the Gas Committee of the Heywood Town Council. He was also a member of the Heywood and Middleton Water Board, of which body he had been Chairman. Mr. Firth, who was a Liberal in politics, was one of the best known public men of the district.

Scottish Junior Gas Association (Western District).—We learn from the Hon. Secretary (Mr. G. Braidwood) that an ordinary meeting of the Association will be held in the West of Scotland Technical College next Saturday evening. Two papers will be read—one by Mr. W. M. Mason, of Glasgow, on "Suggestions *re* Advertising," and the other by Mr. W. Straiton, of Provan, on "Traffic Management in Gas-Works."

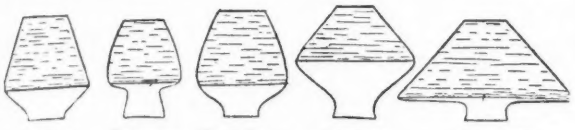
The London and Southern District Junior Gas Association will hold a meeting at the Cripplegate Institute on Friday next, when several short papers will be read and discussed—among them, the following: "Should Gas-Fires be fitted with Adjustable Flues?" by Mr. F. Ainsworth, and "Card Index Systems for Small Gas-Works," by Mr. J. R. Gale. Arrangements have also been made for the members to visit the chemical works of the South Metropolitan Gas Company, at Ordnance Wharf, East Greenwich, on Saturday, the 18th inst.

Adoption of Co-Partnership at the Leamington Gas-Works.—We are pleased to find that the discussion on the subject of co-partnership following the reading of the paper by Sir George Livesey at the last meeting of the Southern District Association of Gas Engineers and Managers, and the further consideration of this important question afforded by the reprinting of the paper and discussion, with some useful advice as to how to introduce the scheme, are already beginning to bear good fruit. We learn from Mr. Thomas Berridge, the Engineer and Secretary of the Leamington Priors Gas Company, that a co-partnership scheme, on the lines laid down by Sir George, has been unanimously approved by the Company's workmen, and came into operation on the 1st inst. This is starting the New Year well. May the example be widely followed.

THE ARTIFICIAL LIGHTING OF SCHOOLS.

Tests of Shades—Arrangement of Lights.

In the "JOURNAL" last week (p. 990), some extracts were given from a report on the above subject by Dr. James Kerr, the Medical Officer of the Education Department of the London County Council, which formed an appendix to the annual report of the Public Health Committee. It may be remembered that in the course of the report it was stated that, for desk work, an incandescent gas-burner without a shade was rather worse than a naked jet, inasmuch as the brasswork of the burner cast a black shadow beneath the light. By reflection from a shade, however, the light could be so distributed as to be practically perfect. The shade, it was stated, should so reflect the light as to obviate the slightest shadow, and enable the lamp, placed at a given distance, to efficiently cover a certain area. It should also protect the teacher's eyes from the direct glare of the exposed mantle. It appears that four varieties of shades were submitted for examination; and it may be of interest to supplement the particulars given last week by the following remarks upon them contained in the report.



SQUAT. CALYPSO. NEW NO. 3. REFLEX. 90° SHADE.

The inadequacy of such a form as the "Squat" is obvious. The sides subtend an angle of 45° to 50°, and do not reflect the light past the massive brass burner. In the "Calypso," with something of a parabolic reflector in its shape, the opaque mass of the burner is particularly effective in stopping the rays. "New No. 3" differs only from the "Calypso" in the shape of the lower clear glass portion, which is immaterial. The "Reflex" is an attempt in the right direction; but its details have been carelessly arranged, so that in class-rooms it may be very objectionable to the teachers. Efficient reflection can only be obtained from a Welsbach burner when the opal sides of the shade subtend an angle of about 90°. The opal upper portion of the "Reflex," $2\frac{3}{4}$ inches vertical, is shaped on this plan, and consequently the shadow beneath the burner is less than with any of the other shades. The lower part of the shade, $2\frac{1}{2}$ inches perpendicular, is of clear glass, so that two-thirds or more of the incandescent mantle is directly exposed to the teacher's eyes; the effect being intolerably dazzling. For this reason, the "Reflex" is quite unfitted for the class-room. This effect is easily remedied by extending the sides with a simple paper shade, figured as the 90° shade globe.

An experiment was made in which the metre-candle value of the illumination was measured on the desks immediately below the burner and then at intervals of a yard along the horizontal desk tops, which were 5 feet vertically below the burner. All the shades were examined in this way. The results found for the "Squat," Calypso, and "New No. 3" were alike, and were 1 metre-candle less than the "Reflex" below the burner. They are therefore omitted from the following table. The experiments were made consecutively with the same burner and mantle.

Table of Results with "Simplex" Burner and "C" Mantle.

Shade.	Perpendicularly below Burner.	1 Yard.	2 Yards.	3 Yards.	4 Yards.	5 Yards.
None	<1	2	2	1+	1	1
"Reflex" globe. .	8	8	5	2	1	1
90° shade do. . .	22	15	7	2	1	1

The improvement on the unreflected light by the use of the "Reflex" shade is great; but the results to be obtained by increasing the depth of the shade are most striking. The gain is obtained by reflecting the rays that would otherwise be dissipated upon the upper part of the walls of the room, and the teacher's eyes are screened from the dazzling of the naked mantle by the depth of the shade. The general wall illumination of the room does not suffer—it is quite as good as when the "Squat" is used; and though not so bright as with the "Reflex," yet, owing to the absence of the dazzling effect of the exposed mantle, it appears better. The shadow beneath the burner can be estimated by the simple test of holding a large sheet of white paper below. When no shade is used, a sheet of paper held a yard below the burner shows a deep shadow more than a yard in diameter. With the "Squat" or the "New No. 3," deep circular shadows about 2 feet in diameter are cast. The "Calypso" throws a small central blot with a secondary outer ring of darkness. With the 90° shade globe, as devised, no shade could be detected, even when the screen was held up to within a few inches of the burner. This 90° shade globe fulfils all the four conditions required for a school globe, and could be made without any difficulty or any material increase in cost as compared with those now in use.

As to the arrangements of lights in schools, the following rules are laid down in the report: (1) Each class-room should be considered as being made up of two portions—the children's area and the teachers' area; and the lighting should be arranged independently. (2) Left-hand lighting must be arranged for as far as possible. (3) In calculating the area over which the rays of a lamp will extend, we must only take into our valuation those rays which proceed from lamps in front of the class to the back of the class. Lamps in front of a class illuminate to some degree the desks of the back row; but lamps to the back of a class do not help to illuminate the front rows of desks when the children are in their places. (4) There must be a clearance of 6 ft. 6 in. beneath pendants; and the luminous mantle must be as closely as possible approximated to this level. Hence burners must be short, and cocks or bye-pass fittings must be placed on one side of the pendant arms, and not between burner and pendant.

From the second and third suggestions, it will follow that the main desk lighting will be arranged to come from the left, and somewhat in front of the child. The gas-fitter should mark the position of the first lamp to be hung over the centre of the first dual desk on the child's left of the front row. Proceeding, lamp positions should be marked out along the front row at from 6 feet to 9 feet intervals, according to the height of the desks from the floor—being closer in infants' schools, and farther apart in those for the higher standards. The row of lamps thus marked out would give sufficient light for the front row and the second row of desks. A second row of lamps, similarly spaced, would light the third and fourth rows of desks. Since a lamp hung behind a child throws no light upon the desk of that child, it follows that the space between the lamps from the front to the back of a room should be less than that between the lamps from side to side. Dr. Kerr gives a plan of a model room, to accommodate forty, to exemplify his remarks on the arrangement of lights.

A COMPETITION FOR SMALL GAS-ENGINES.

In the "JOURNAL" for Nov. 5 last (p. 420) notice was drawn in a short paragraph to this year's competition, arranged by the Société Technique du Gaz en France, for small engines using town's gas, and suitable for domestic and other purposes. The President (M. Coze) has just recently issued fuller particulars. The possible prize of 10,000 frs. (£400) is an attractive one, and we hope there will be British competitors forthcoming. Any such should, of course, at once apply to the Secretary of the French Gas Society, No. 105, Rue St. Lazare, Paris, for all details. The date for the sending-in of entries has been extended from the 1st inst. to April 1 next. Entries must be made on the form that can be had on application. They must be accompanied by a short descriptive note of the engine, with drawings, and a copy of the patent (if any). The tests will begin on June 1, and will take place in the Laboratory of the Conservatoire National des Arts et Métiers, Paris. The engines will be tested for two hours under full load, and for one hour each at half load and running free. Particular attention will be given to (*a*) consumption of gas, (*b*) conditions of lubrication and consumption of oil, (*c*) cooling arrangements, and (*d*) the effective power and thermal yield (calories per horse power). The brake tests will be by dynamos; the coupling-up for engines of 2 H.P. and below will be by wooden pulleys; for engines above that power by a special coupling-piece according to a template which can be obtained on application. Other points to which special notice will be given are (*a*) the bulk of the apparatus, (*b*) the arrangement of its parts as to their accessibility for dismounting, and as to the covering-in of the plant, and (*c*) the ease in starting, and facility in regulating, lubricating, upkeep, and steadiness of working. Except for the supply of oil, all costs and charges will be borne by the Society; but the competitor or his representative will have to be present at the test. We trust that a good number of competitors will enter, and thus assist in further developing the use of coal gas for domestic and industrial purposes.

The Management of the New Gas-Works in Milan.—We learn that Mr. A. Clement Hovey, of North Shields, has been selected by the Directors of L'Union des Gaz as Manager of their new works in Milan, in succession to Mr. L. M. Snelgrove. The details of the arrangement are not yet complete; but, so far as the Company are concerned, the appointment is definite.

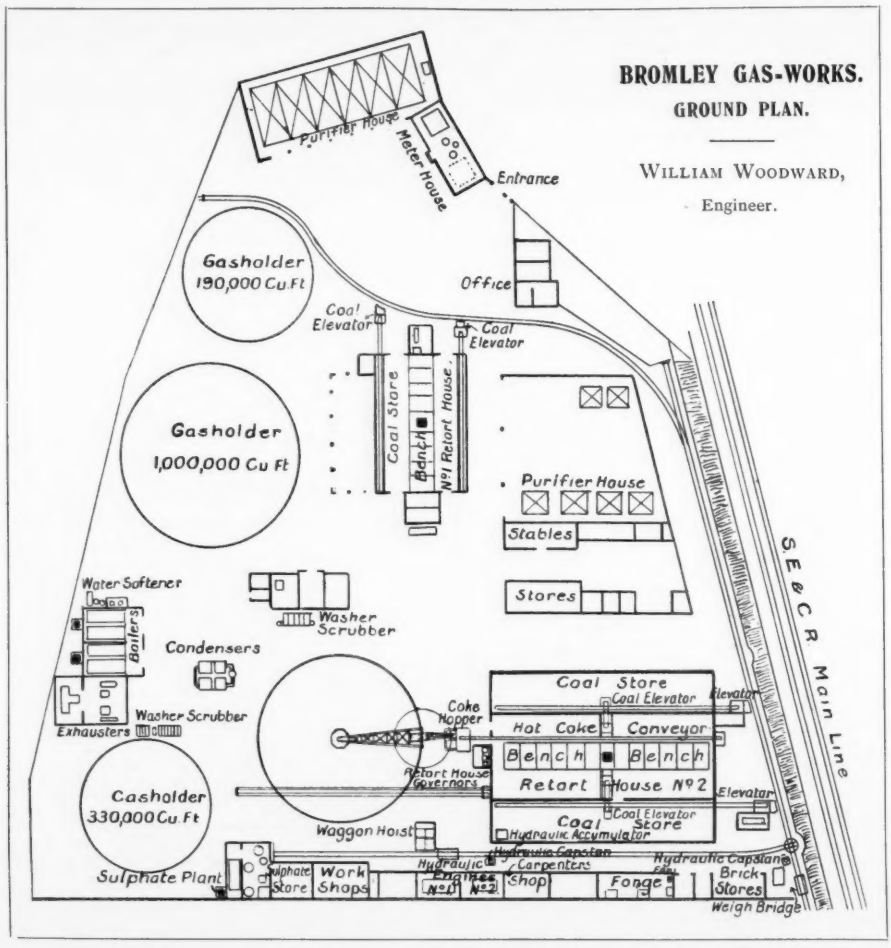
Preventing the Freezing of Water in Gasholders.—Mr. E. H. Yorke, of Portland (Me.), has sent to the "American Gaslight Journal" particulars of a device for preventing the freezing of water in gasholder tanks and cups. It consists in automatically controlling the volume of steam employed for the purpose, so that the man entrusted with this duty is relieved of the responsibility of exercising judgment, and only follows rules laid down. The device is simply a "manifold" in which are inserted $\frac{3}{8}$-inch steam-cocks having small round openings. These manifolds to the different holders are grouped together in one room. A large dial thermometer is located outside the window, in a ventilated box; and on the wall hangs an instruction card giving the number of cocks to be turned on at the different temperatures, ranging from 32°, and each multiple of 4° below freezing-point. The plan is a simple one; but it is stated that the results which are secured by it make it an important improvement on the old and wasteful method hitherto generally employed.

A VISIT TO THE BROMLEY (KENT) GAS COMPANY'S WORKS.

The Modern Development of a Gas-Works Plant.

THERE are very few gas undertakings that are not prosperous even in these days of strenuous competition; but the tale of prosperity is divided into two parts. Of one part, comprising the commercial and financial results, we hear half year by half year at the meetings of the fortunate proprietors; but of the other part, in which are comprised works developments and manufacturing economies, we in many cases hear but little. The reason is not far to seek. Proprietors, as a rule, regard as the index of prosperity the balance of gross profits standing at the foot of the revenue account; and their greatest interest is to know, in general terms, the influences that have caused the balance to rise or descend, and the influences in prospect that may affect future balances for good or ill. Through this we hear but cursorily of what is proceeding at the works. Among gas undertakings whose commercial and financial prosperity has been followed in these columns for many years through the illuminating addresses of the Chairman (Mr. Alexander Dickson), is that of the Bromley Gas Consumers' Company. In his addresses, he has also sufficiently—for the proprietors—told of the development of the Company's works, and of the manufacturing economies realized; but for gas technicians the sketch, it is found, has not by any means exhausted the interest. However, what Mr. Dickson has said induced the writer to recently pay a special visit to the works, round which he was shown by Mr. William Woodward, the Company's Engineer and Manager of now seventeen years' standing.

About the works and their engineering and management, the writer can, from his independent position, say what those more closely identified with the concern would not say; and there is no necessity to ask anyone's permission to speak of things here as they are found. Mr. Woodward has always been of a modest disposition regarding his work; and we must say at once that he is the author of much that is of considerable interest at Bromley. In most gas-works, there can be found in some novelty in plan, device, or procedure, the hand of the engineer; but there are engineers and engineers. There are engineers who can plot out



their land, and apply standard plant in an ingenious manner, supervise its erection, and get fully what their company or committee pay for; there are other engineers who are endowed with inventive skill that enables them to branch out into new lines of equipment in adapting site to requirement, and to branch out into improvement of the existing types of plants, and so increase their productiveness or heighten their efficiency in operation. Among the latter engineers, the visit to the Bromley works permits the placing of the writer's courteous guide to their interesting features.

PAST AND PRESENT CARBONIZING.

While looking round the works, the years that have passed were penetrated. Diplomatically put inquiries soon tested the memory of Mr. Woodward. It was gathered that, when he took charge of the Bromley Company's works in 1890, the output of gas was only about 120 million cubic feet a year. In the past year, the make was about 320 millions. Seventeen years ago, the works consisted of two retort-houses, containing efficient plant of its period; but the settings were all direct-fired, and the production of gas per mouthpiece was only small—viz., 3500 to 4000 cubic feet. During the few years preceding 1890, regenerative firing ranked prominently among gas polemics; and within four years after Mr. Woodward's arrival, No. 2 retort-house was relieved of its ten settings of seven through, direct-fired retorts, and the more scientific system of heating was adopted—the increasing consumption of gas, and the necessity for taking advantage of the economies represented by increased yields from the coal carbonized, being the propelling factors in taking in hand the improvement of the works. No. 2 retort-house was then lengthened some 20 feet, was cellared, and regenerative furnaces of Mr. Woodward's own design were built. The retort-house is now 160 feet long and 60 feet wide; being flanked on either side by coal-stores, each 30 feet wide—the stores having a combined capacity of 4000 tons. Twelve beds of eight through ⊓ retorts, 22 inches by 15 inches by 20 feet, were constructed; the retorts in each setting being in two vertical tiers of four. The producers are a special feature of these settings. They are fitted with bars set at an angle of 60° from the horizontal. The feature increases one's interest as it is learned that the furnaces never require clinkering—in fact, some of the bars have not been taken out of the furnaces for two years, which is a matter of importance in the minimizing of retort-house labour. From the design of settings adopted some thirteen or fourteen years ago, there has never been any call upon Mr. Woodward to depart; and looking to-day at the good and uniform heats, his fidelity needs no explanation. But this is the result of the application of the higher scientific method of working—that whereas the production

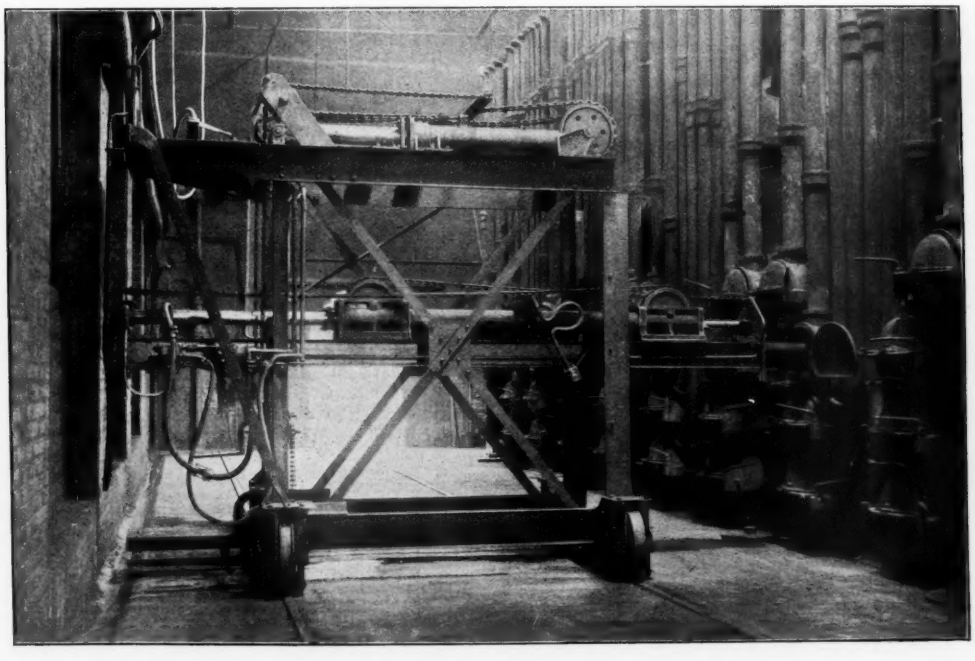
In No. 2 Retort-House.

with the former direct-fired retorts was 3500 to 4000 cubic feet per mouthpiece, the make with these settings is 9500 or 10,000 cubic feet per mouthpiece. In other words, taking the top figures, by the extension of the house by some 20 feet, by putting in two extra settings, and eight retorts to a setting instead of seven, and by reconstructing on the regenerative principle, the capacity of the house has been raised from 560,000 cubic feet per day to 1,920,000 (or, say, 2 million) cubic feet. The make to-day of 9500 to 10,000 cubic feet per mouthpiece will arrest the attention of practised gas makers; and we cannot question the veracity of the figures when, on the day of the writer's visit, eight beds of the retorts had been at work, and the station-meter registered a make during the preceding twenty-four hours of 1,285,000 cubic feet, using Durham coal, with six-hour work, or 10,040 cubic feet per mouthpiece. But the whole of the improvement in production is not credited to the regenerative furnaces. Cowan's retort-house governors have been adopted; and to them must be attributed some part of the advanced yield of gas from about 10,000 to 12,500 cubic feet per ton of coal carbonized.

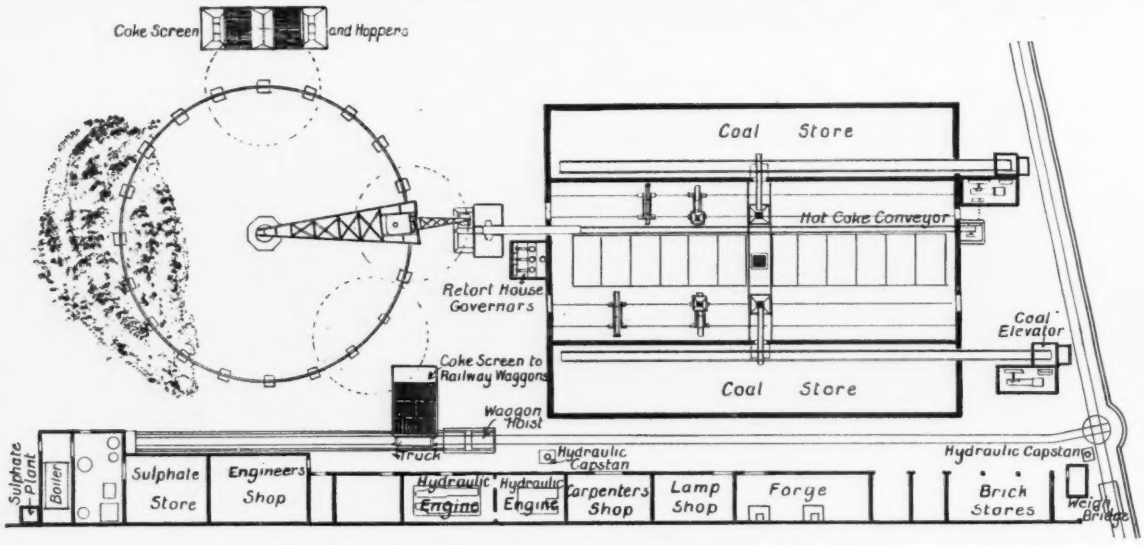
Another point noticed in the house is the use of tar columns; and it will interest many readers to know that these were used by Mr. Woodward many years before he went to Bromley.

The Handling of Coal.

For a works well to the south of London, dependent on the South-Eastern and Chatham Railway for coal supplies, they are not badly situated. The railway runs at the southern end of the retort-house that has been described; and there are low-level branch sidings into the works. The waggons laden with coal are received in these sidings, and are then hauled by hydraulic capstans. At the end of the coal-store are sunk hoppers, with coal-breakers; and into these the whole of the coal is tipped. The coal is then elevated by two gravity bucket conveyors which travel overhead the full length of the coal-stores, depositing the coal in them wherever required. The buckets of the conveyors are 3 ft. 3 in. long, and are suspended on a central endless chain, running on rails. The buckets maintain a vertical position until they meet the tilting apparatus, which is a travelling arrangement running to any spot on the course of each conveyor. The conveyors (which, with the coal-breakers, are driven by two small steam-engines) have been at work for seventeen years, and they have not cost during that period £20 for repairs. That is high testimony indeed, and a no less interesting feature is that the conveyors were made on the works. Indeed, the amount of home-made and well-made engineering constructional work is one of the features of the entire plant. Excellently equipped shops,



Woodward's Hydraulic Pusher.



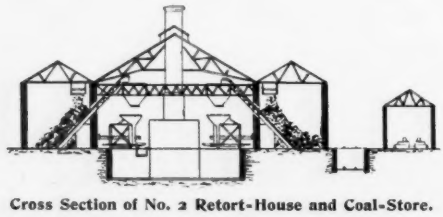
Plan of No. 2 Retort-House and Coal-Store, with Contiguous Buildings.

with modern machine tools, have been a good investment for the Company. The plant that raises the coal from the stores into the overhead hoppers for feeding the charging-machines in the retort-house is of ordinary type.

Going into the retort-house, it is seen that the charging is accomplished by what were originally Foulis hydraulic stokers. They interest; for in detail the likeness to the old form has been almost completely eliminated. They have been redesigned and rebuilt by Mr. Woodward, producing simplification and improved operation and result. The working of the improved machines was watched. It was seen that the manual power exerted is so small that any intelligent child could operate them; the charges can be put in as heavy as the operator may determine; the quantity of coal at each entry of the scoop can be regulated to a nicety; and there is no overlapping of each portion of the charge. Looking into a number of retorts, the charges were found to be perfectly level. The ingenuity displayed in the conversion of the machine cannot but be admired.

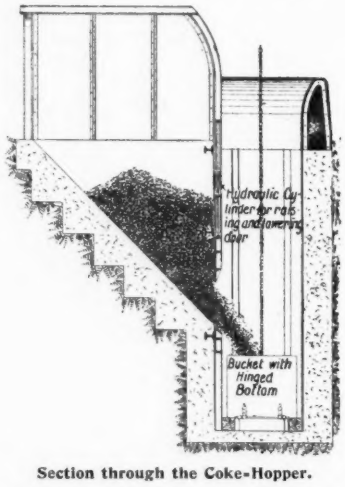
A New Pusher—A Many-Featured Coke-Handling Plant.

Without disparaging numerous other features of the works, the writer must say that, between the operation of expelling the coke from the retorts to its despatch by rail or road, there is quite sufficient to repay a visit to Bromley. Right at the beginning, there is found something new. "The old order changeth." The Foulis drawing-machines have passed from their former scene of activity; and a new hydraulic pusher has now been adopted. Designed by Mr. Woodward, the pusher was constructed in the Company's fitting-shops; and it must be said that in smoothness and precision of operation, it would be hard to excel this machine. It is not for the writer to give away all the details of any engineer's work; and therefore the machine may be left, with an expression of admiration of the manner in which it is accomplishing its work. In choice between drawing charges and expelling by a pusher, Mr. Woodward has no hesitation whatever in pronouncing in favour of the latter. The reasons are manifest—a single machine, the coke all dealt with on one side of the house, a single coke-conveyor only, the coke ejected in large size, and the effect of the work upon the retorts in the way of wear and tear brought to what may be termed the irreducible minimum. With such advantages, he finds no reason for questioning the superority of the latter-day method, or rather the method he has had in use now for some two years.



Cross Section of No. 2 Retort-House and Coal-Store.

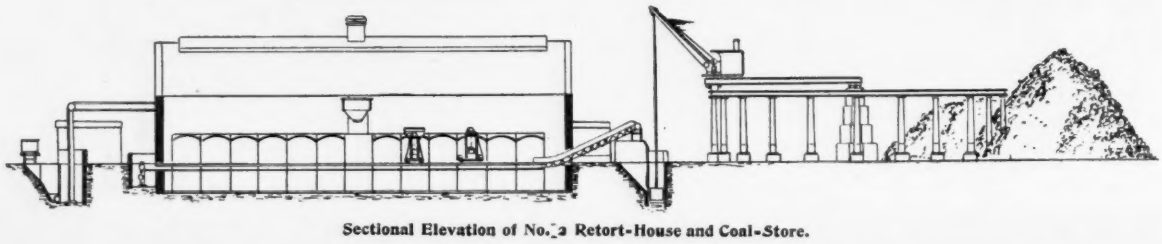
The 20 feet charges fall on to a De Brouwer conveyor, which has been at work about a year-and-a-quarter, and was put in by Messrs. W. J. Jenkins and Co., of Retford. The conveyor (which is operated by the same engines that drive the coal plant) has not been out of action for some thirteen or fourteen months now; and this testimony speaks well for it. By it, the coke is transferred to a large coke-hopper a few yards outside the retort-house. The hopper, which embodies several interesting features, is capable of holding the whole of the output of coke from the house for sixteen hours—thus enabling all the outside coke plant to remain entirely idle during the night. From this one fact



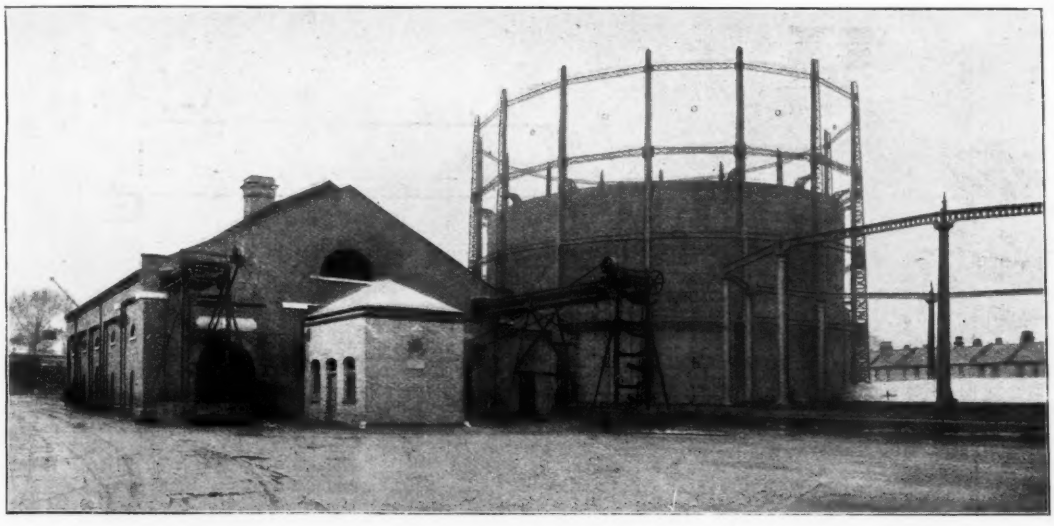
Section through the Coke-Hopper.

alone, it will be appreciated that, in its very commencement, the scheme of the coke plant here has been designed for economical working. Pause may be made at this point to incorporate a brief description of the hopper, the construction of which is further explained by the sectional drawing. It is a concrete structure lined with blue bricks; and with the exception of the upper 10 feet it is wholly below ground. The part above ground is formed of $\frac{3}{8}$-inch boiler plates. The bottom of the hopper is set at an angle of 45°—inclined towards the front to cast-iron sluice doors. In front of the hopper is a deep well, of greater depth than the hopper itself, so as to allow of the crane bucket (to which reference will presently be made) being lowered into the well, with its upper part below the bottom of the sluice doors. By this arrangement, on the bucket being in position, and the sluice doors opened, the coke will flow into the bucket by its own gravity.

The work of emptying the coke-hopper, and distributing the



Sectional Elevation of No. 2 Retort-House and Coal-Store.



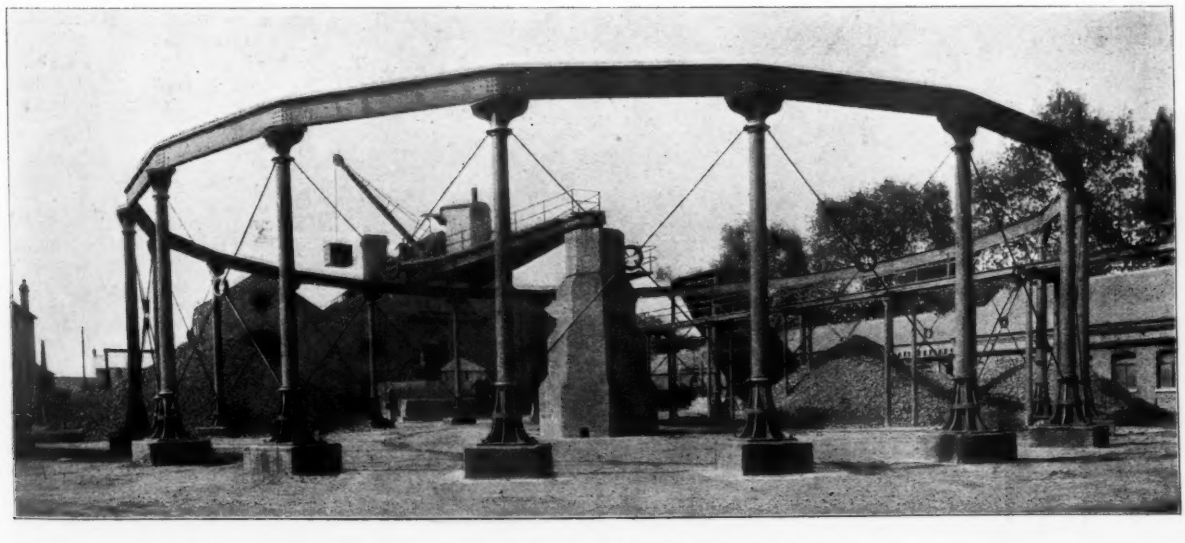
A General View of One Part of the Works.

coke in the yard or into railway trucks, is performed by a revolving wharf crane, fixed on the outside of a radial arm, running on a circular elevated gantry, 24 feet high and 110 feet diameter. The radius of the crane is 30 feet; and adding this to the 55 feet of radial arm, gives 170 feet as the total circular diameter that the crane will reach, besides which the coke, if stacked, would run down at an angle of 45° from this to the ground, so that the extensive stacking capability of the arrangement will be remarked—in fact, it practically covers the whole of the yard, and is capable of storing 8000 to 9000 tons. The gantry, with its foundations and central column, was constructed by the Company's own workmen, in their own workshops. The gantry is a plain structure, consisting of twenty columns, 20 feet high and 12 inches in diameter, bolted to solid concrete foundations. On top of these are mounted rolled girders, 24 in. by 7½ in., and weighing 100 lbs. to the foot. The radial arm is anchored from a pivot bolted to the central column, also of solid concrete. The radiating end of the arm runs on wide rollers on top of the girders of the gantry. These rollers are of solid steel and about 2 ft. 3 in. wide—this width being necessitated to cover the inequalities of the girders, which are not set to a true radius, but are straight from column to column. Surmounted on the arm is the 3-ton steam crane, made by Messrs. Thomas Smith and Sons, of Rodley. The crane carries a bucket (capable of holding one ton of coke) with mechanically acting bottom doors operated by the crane driver. The bucket is lowered into the well in front of the coke-hopper. The sluice-doors are opened by hydraulic power; the coke gravitates from the hopper into the crane bucket; and the sluice-doors are then closed. At a signal, the crane driver operates his machine, lifts the bucket, traverses it wherever necessary within the radius of his crane and arm, and deposits the load into the coke-store, on to a coke-screen, or into the hoppers over the coke-breakers in the yard. One very noticeable feature about this system is that the coke can be lifted, and put down wherever required right to the ground; and so there is, comparatively speaking, an infinitesimal breaking of the coke. Another advantage this manner of operation possesses is that, wherever the coke is put, the means by which it was put there can remove it again. This, of course, is not so with ordinary coke-conveyors, which can carry the material to a certain place, but cannot remove it again.

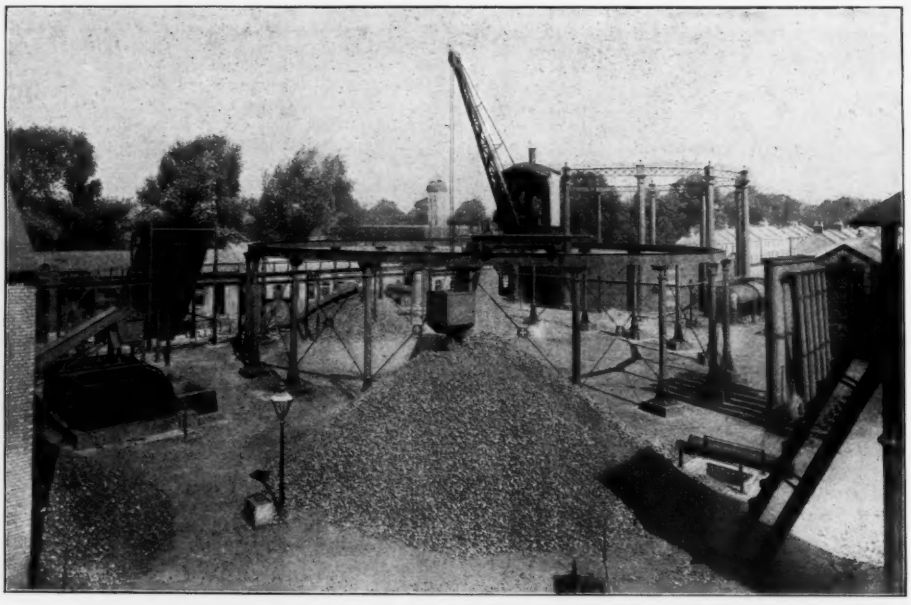
We have spoken of a coke-screen; and that is another leading feature of this coke plant. It constitutes the principal part of the plant for loading railway waggons. In the first place, there is a dock capable of taking nine or ten waggons, which are lowered into, or lifted from, the dock by a 20-ton hydraulic hoist at the south end—hydraulic capstans drawing the trucks to and from the dock. [This dock was originally constructed to enable the loading of railway waggons with coke at ground level.] Over the part of the dock next to the hydraulic hoist is the inclined coke-screen. This is 12 feet wide and 20 feet high vertically at its topmost point, and is set at an angle of 40°. Beneath this expansive grid is a hopper for collecting the breeze. A railway truck having been placed under the screen, the *modus operandi* is as follows: The coke is lifted from the storage hopper outside the retort-house by the crane bucket in 1 ton quantities; the bucket is radiated round; the coke is dropped on to the top of the screen; the fine falls through the screen; and the large runs gently down the incline into the railway trucks. The coke sent away is thus of good size and clean. The economy of labour for loading is great. On the day of the visit, only four boys had been engaged loading with coke ten railway trucks, including their marshalling, weighing, &c.

No. 1 Retort-House.

Before generally sketching the remainder of the plant, a brief description of No. 1 retort-house may be introduced here. This house, owing to No. 2 doing so remarkably well, is not working at the present time. Its situation is seen on the plan; and its most interesting feature is found in the large producers for heating the settings—as many as 48 through retorts being heated in this house from one producer. The retorts are in eight settings of six



The Circular Gantry on which the Coke-Crane travels.



Storing Coke in the Yard by Crane and Bucket.

retorts, 22 in. by 13 in. by 18 ft. ovals, in two vertical tiers of three. The make per mouthpiece in this house is only 7000 cubic feet; the shorter length of the retorts, of course, assisting in causing a difference from No. 2 house. There are two producers in the house; but only one is worked at a time—the second being there merely as a stand-by. These producers were adopted so as to save cellaring the whole house; but a few questions elicited the fact that Mr. Woodward prefers the system of a producer to each setting as in No. 2 house. This house is equipped with coal-bins on either side; and from the bottom of these, the coal gravitates for scoop-work. The coal-bins are supplied with coal by means of conveyors similar to those feeding the stores of No. 2 house—the conveyors running direct from the railway siding at the end of the house.

Reversible Condensers.

Following the course of the gas from the retort-house, a brief survey of the remaining plant may be made. The condensers were erected to Mr. Woodward's design by Messrs. Clapham Bros. The set consists of four vessels, 5 feet square, 16 feet high, filled with water-tubes, with 24-inch connections through one five-way centre-valve. These condensers are reversible both for gas and water.

The Exhausters.

The exhausters are housed in a really handsome building, lined with enamelled and Ruabon bricks, attractively broken up into panels. There are installed two exhausters of Gwynne's make, each of a capacity of 35,000 cubic feet per hour; and a pair of

The Coke-Storage Hopper.
(Crane bucket descending for filling.)

The Inclined Coke-Screen and Dock for Loading Railway Waggons.

Waller's exhausters (driven by an engine of Mr. Woodward's design), each of a capacity of 80,000 cubic feet per hour. The whole of the connections are 24-inch.

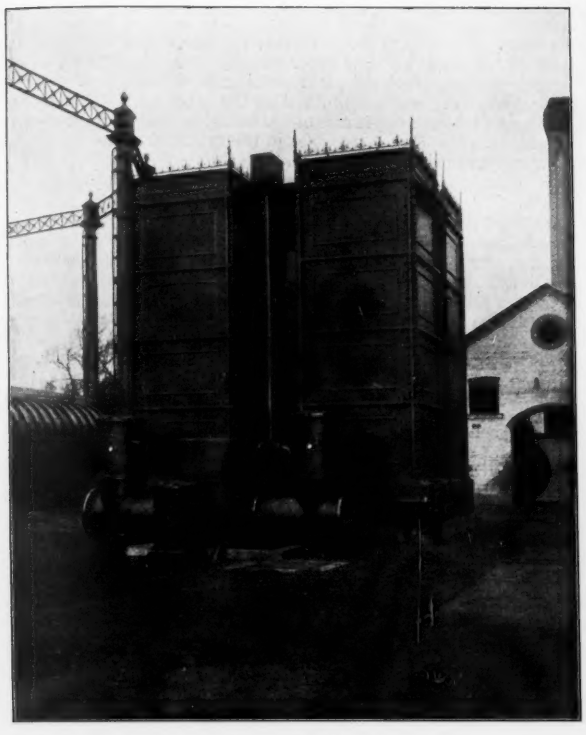
The Washer-Scrubber, and Naphthalene Experiences.

The washer is one of Holmes's make. It is observed that it is somewhat different from the ordinary, being engine-driven from the middle instead of at one end. The first three bays are used for taking up naphthalene, and are therefore charged with oil. At present Mr. Ferguson Bell's "Solvene" is being used. During several years' experience in endeavouring to get rid of the naphthalene nuisance, various oils have been tried at Bromley; but "Solvene" is the only one that has been really successful there. Other tests are being made with the view of realizing further improvements. After the first three bays of the washer, the gas undergoes the usual washing with strong liquor, and clean water follows—the whole of the ammonia being removed from the gas.

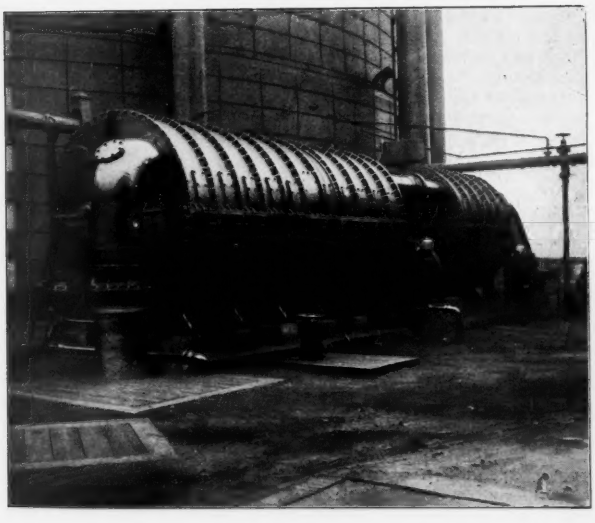
The Purifying Plant.

On leaving the washer-scrubber, the gas is divided into two streams—part passing through the old purifiers, and part through a fine set of new purifiers. The old purifier-house contained six boxes, 20 feet square, and worked exclusively with oxide of iron.

The new purifier-house contains six boxes, 40 ft. by 20 ft. by 5 ft. 6 in. deep. These are mounted upon an iron staging, in a large house, with a brickwork enclosure on three sides and open in front. The height from the ground level to underneath the floor of the purifiers is 15 feet. The purifiers are water-luted; the seals being 3 feet deep. A feature of the covers is seen in the photograph. They are flat on top; and the necessary trussing is on the outside. The trussing end-pieces are utilized for holding down the lids. The covers are lifted by a Goliath crane traversing the whole length of the house. The boxes are fitted with Spencer's grids; and the oxide is emptied through the bottom of the boxes on to the revivifying-floor below. After revivification, the oxide



[Condensers, Reversible for both Gas and Water.



Washer-Scrubber, Engine driven from the Middle.

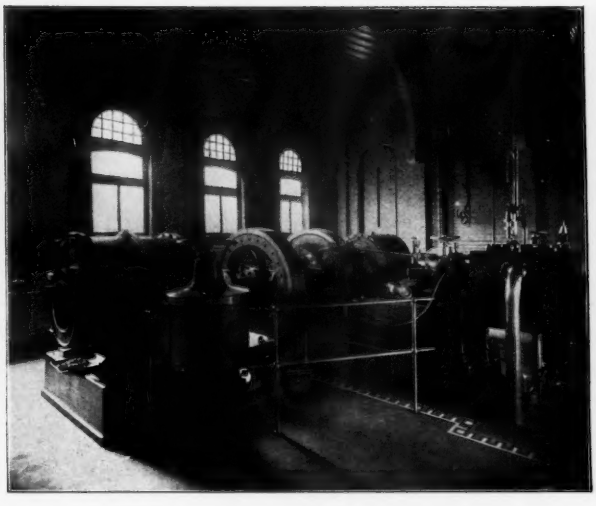
is lifted by elevators, and emptied into the boxes through long spouts. The house (as are so many purifier-houses nowadays) is lighted by electricity, furnished by a little generating plant on the works.

Meter-House, Gasholders, Sulphate Plant, &c.

Passing to the meter-house, we have again a handsome brick structure, lined with enamelled and Ruabon bricks, broken up into nice panels. The roof is pitch pine; and the whole place is light and airy. An interior of this kind costs, in the first place, a little more money than a plain interior; but, in the long run, there is a saving, for nothing, it is learned, is ever spent on

The New Purifiers—Flat-Topped Covers and Outside Trussing.

redecoration here. It is altogether unnecessary. In the house there is a 60,000 cubic feet Parkinson station-meter, two 24-inch Cowan governors, and one bye-pass safety governor. The foundations are in for a second meter; and, in connection with this preparation, it is remarked that the doorway in the building is



The Exhauster-House.

large enough to pass a meter-drum. The whole of the gasholder inlets and outlets are operated from this house; so that the valve man has not to travel from one holder to another to operate the valves.

There are three gasholders on the works; their capacities being

Station Meter and Governor House, in which the Gasholder Valves are also assembled.

1 million, 350,000, and 200,000 cubic feet respectively—a total storage of rather more than 1½ million cubic feet.

The fine sulphate plant claims notice. It was practically made on the works; one special feature being a copper saturator. This has been found most efficient—about 1500 tons of sulphate having already been lifted from it; and it is as good to-day as when put in five years ago. It is light, and much less costly than a lead one. The capacity of the plant is 4½ to 5 tons of sulphate a day.

A good range of four Lancashire boilers, 8 feet in diameter and 25 feet long, supply steam to all parts of the works. There are two furnaces to each boiler; and all are fitted with Meldrum's forced draught.

The works are thoroughly well equipped with workshops; and hydraulic power, at 750 lbs. pressure to the square inch, is carried to all necessary parts of the plant.

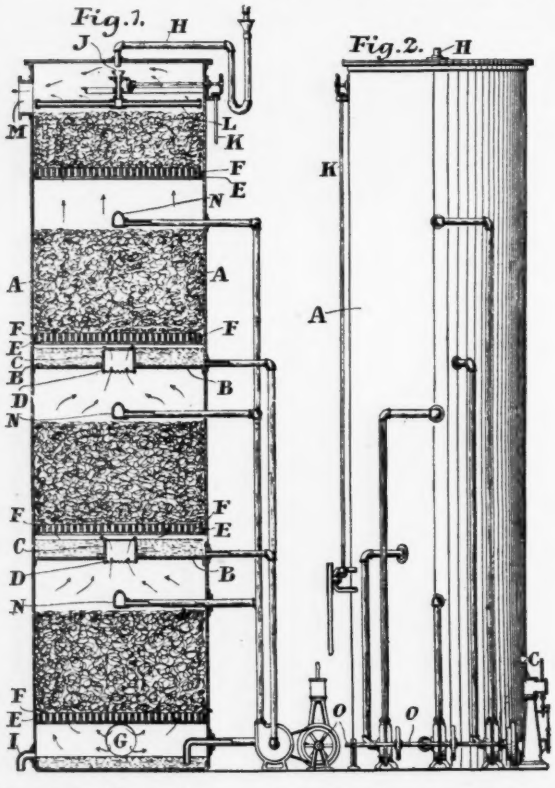
The site on which the works stand is about 5 acres in extent; and there is room on it for another retort-house (should it be required), equal to an output of 2 million cubic feet of gas per day

Looking round the works, the cleanliness and quietness that reign everywhere, all brought about by the scheme of mechanical operation, cause the mind to revert to days of long ago, when, with a smaller output, the antithesis of present conditions was generally the rule in gas-works. Mr. Woodward is thanked for the interest derived from the visit, and for the excellent set of photographs and drawings he has placed at our disposal for illustrating this article.

AN AMERICAN GAS-SCRUBBER.

THE last number to hand of the "American Gaslight Journal" contains the specification of a patent granted to Mr. E. F. Lloyd, of Detroit (Mich.), for "new and useful improvements in gas-scrubbers." The following particulars, with the accompanying illustrations, will give some indication of the nature of the invention.

The patentee points out that the various valuable constituents of coal gas, as well as ammonia, have a strong affinity for fresh water, and, consequently, when water is used in any great quantity, the gas is deteriorated by being robbed of these elements, and the resulting ammoniacal liquor is very weak—requiring an expensive distillation process to make it marketable.



The prime object of the invention is, therefore, to effect the removal of all the ammonia from the gas with the use of a minimum amount of water, and to provide for the purpose an apparatus, the construction of which is such as to obviate the necessity of making the device of excessive height, and thus expensive and inconvenient to operate and house. A further object is to provide a simple structure which may be easily cleaned and refilled, and requires but little power to operate. In the following illustrations, fig. 1 is the section and fig. 2 the side elevation of a device embodying the invention.

The apparatus consists of a vertical cylindrical shell A, divided into a series of chambers by water-tight bottom partitions B, each having an axial opening into which is fitted an overflow thimble or pipe C, extending upwards within the bottom of one chamber a short distance, to maintain the ammoniacal liquor therein at the height of the thimble, and projecting downwards a very short distance into the top of the chamber below. The downwardly projecting edge D is serrated, to assist in breaking up the stream of gas as it flows from the lower to the upper chamber.

Just above the upper end of each of the two thimbles is removably supported, by an angle-iron ledge E on the outer wall, a grid F, formed of transverse slats; a similar grid is provided in the upper chamber near its upper end; and another in the bottom chamber just above the gas-inlet G in the side-wall of the chamber. Upon each of these grids is a quantity of light, porous substance, such as coke, or other suitable material, through which the gas may pass freely, and in passing be divided and come in contact with the water contained in the material. The water is introduced into the upper end of the casing or column by a supply-pipe H, and, working down through the material to the bottom of the upper chamber, overflows through the thimble, and so passes down the column to the bottom, where it is carried off through the pipe I.

On entering the apparatus, the water passes into the open funnel-shaped end of a vertical pipe J, supported in a suitable bearing, and adapted to be revolved therein by bevel-gear on the pipe in mesh with similar gear on the end of a shaft, extending through a bearing in the side wall of the chamber, and receiving motion from a vertical shaft K connected thereto by bevel-gears. On the lower end of this vertical pipe is a transverse perforated pipe L, into which the water passes from the vertical pipe, and from which it escapes through the perforations as the pipe is revolved, and is distributed evenly over the surface of the scrubbing material below. Opening through the side of the chamber above the material is the gas-outlet M.

In order that the scrubbing material below that which is wetted by the rotary sprinkler may be kept thoroughly saturated without the necessity of introducing large quantities of water, a draw-off pipe leads from the bottom of each chamber to a suitable pump, and the liquor thus drawn off is forced by the pump through a pipe leading into the same chamber above the scrubbing material therein, and is sprayed, through a nozzle N, upwards in a flaring spray against the bottom of the chamber above, upon which it collects in drops, and falls vertically downwards upon the scrubbing material. There is preferably a pump for each chamber, so that the liquor therein will be kept separate from that in the other chambers—it being of varying strength in the different chambers. These pumps are all driven from a common shaft by means of pulleys and belts or otherwise; the shaft being driven by any suitable engine or motor. The vertical shaft K, for actuating the rotary sprinkler, is also driven in any suitable manner, as by a belt, from the engine or driving-shaft.

In another arrangement of the apparatus, the thimble C is dispensed with, and an overflow flange secured to the upper side of the bottom round the opening, and a rectangular perforated plate supported beneath the opening in the bottom, at a certain distance below it, by a rectangular frame, formed of angle-iron, secured to the under side of the bottom. The liquor sprayed from the nozzle below strikes this plate, and the gas in passing through the perforations therein is divided into thin streams, and brought into contact with the liquor adhering to the plate.

The action of the apparatus is as follows: The ammonia-laden gas enters the bottom section of the column through the inlet G, and in passing upward through the grid and scrubbing material is thoroughly diffused and brought into contact with the ammoniacal liquor which is constantly flowing downwards. In passing up, it is brought to the centre of the chamber in order to go through the axial opening in the bottom; and it thus flows across and through the spray issuing from the nozzle, as well as through the down-pouring drops falling from the bottom. In ascending through the sections above, the gas is subjected to the same treatment; and it finally goes through the thin bed of scrubbing material at the top of the column, which is saturated with fresh water, and thus, by reason of the strong affinity of the ammonia for the water, all traces are removed from the gas. In this construction, only a small quantity of fresh water is required; and as the gas passes so frequently through the ammoniacal liquor contained in the different chambers, by the time the water reaches the bottom of the column, it will contain a large percentage of ammonia.

The Pitometer.—The "Journal of the Franklin Institute" for last month (just received) reports that at the meeting of the Mechanical and Engineering Section held on Oct. 31, Mr. Edward S. Cole, of New York, read the paper of the evening, on the "Pitometer"—an instrument specially adapted for measuring and locating the leakage of water in water-mains, from imperfections in pumps, and other sources of waste in the water supply of cities. The paper was fully illustrated with the aid of lantern pictures. The discussion which followed was participated in by Mr. J. C. Trautwine, jun., Major Cassius E. Gillette, late Chief of the Bureau of Filtration in Philadelphia, Professor Easby, of the University of Pennsylvania, Mr. Bamberg, representing the United Gas Improvement Company, the Chairman (Mr. Charles Day), and others.

ASSOCIATION OF WATER ENGINEERS.

WATER SUPPLY OF PARIS AND SUBURBS.

Mr. Easton Devonshire read a paper on the above subject. It consisted of some notes prepared by him, at the wish of the Council of the Association, in order that the members as a body might have something in the shape of a report on the visit to Paris in June, in which only a few of them were able to take part. In the paper, the author gave his own impressions in regard to the works visited, together with some supplementary information which he was able to obtain through the kindness of several of the Engineers who received the Association so hospitably. The works inspected consisted of those of (1) the City of Paris, supplying the population contained within the fortifications; (2) the Compagnie Générale des Eaux, serving all the surrounding communes, excepting those enclosed in the loop made by the Seine to the north-west of the city; and (3) the Compagnie des Eaux de la Banlieu, supplying the district defined by this loop. Mr. Devonshire described these various works in pamphlets prepared by him for the visit, which were noticed in the "Journal" at the time; and he now introduced his supplementary notes by a brief *résumé* of the particulars previously furnished.

Dealing first with the works of the City of Paris, the author explained that the supply is dual—the potable water being entirely separated from that required for other uses than drinking, and each water having its own reservoirs and distributing mains. The potable water is obtained from springs, supplemented by water from the Seine and Marne, after filtration. There are eighteen reservoirs; their total capacity being: Spring water, 134,310,000 gallons; river water, 33,770,000 gallons; Ourcq Canal water, 5,434,000 gallons. The water supply for other than potable purposes is pumped from the canal and the above-named rivers. The total length of mains at the end of last year was 1656 miles, of which 18 miles were of coated sheet-iron or steel, and 7½ miles of armoured concrete. The quantity of water drawn from the aqueducts in 1906 was upwards of 19,000 million gallons; and the filtering stations furnished 16 million gallons. For purposes other than drinking, nearly 39,000 million gallons were used; and the total consumption was 58,240 million gallons, or 57½ gallons per day for a population of 2,763,393. There are fourteen pumping-stations, containing machinery of 8330 H.P. nominal, of which 700 H.P. is hydraulic. The total quantity of water pumped during the year was 15,517,301,800 gallons; the average lift being 182 feet. The almost exclusive use of single-cylinder horizontal engines is a peculiarity which struck many of the visitors; and the author asked M. Dutoit, the Engineer in charge of the machinery, the reason for adopting this type of engine. His reply was that the use of low-pressure boilers, the slow speed required from the pumps, and their direct drive, caused a single-cylinder engine to give very satisfactory results, since he had in certain cases an expenditure of coal of less than 1·08 kilos. (2·38 lbs.) per horse power of water lifted per hour. The average consumption of coal at the thirteen steam-pumping-stations was 3·4 lbs. per horse power; and the author does not think these figures will tempt English engineers to abandon double and triple expansion engines with high-pressure steam. The boilers mostly in use are tubular or semi-tubular.

The method generally followed in Paris, of laying the mains in sewers or in specially designed culverts, is, the author believes, almost unique among the water supplies of great cities. He thinks the economy claimed for it is conceivable only on condition of the original sewerage system and the water-mains being designed simultaneously at the outset. In the sewer traversed by the visitors in June, there were two trunk mains, 24 inches and 32 inches in diameter respectively, carried on iron standards over their heads, besides smaller pipes for water and compressed air, and many telegraph and telephone wires. The method of jointing the mains aroused special interest. The straight-ended pipes without socket or bead, and the narrow double collars in which the lead joint is made, were described by the author in one of his pamphlets; but as the practical way of making a tight joint with collars so large in diameter and so narrow in width seemed puzzling, he asked M. Vibert, the Engineer in charge of the mains, for a few words of explanation. M. Vibert gave the following information:—

The pipes with ring collars (see fig. 1) are used in the sewers only, and never in the ground. This system of joint is evidently less solid than the socket joint. It lends itself, however, to great flexibility; but over metallic bridges and in unstable ground we prefer the Gibault joint (see fig. 2), which is still more flexible. Originally the collar had a width of 4 inches only, whatever the diameter of the pipes (even with 44-inch pipes). For the last 12 years the dimension of the collar is 4 inches up to a diameter of 24 inches; but it is 4¾ inches for 28-inch and 30-inch pipes, 5¾ inches for 36-inch, and 6 inches for 40 and 44 inch. In laying, the collar is slipped over the pipe, placed astride the joint, and centered by means of small lead wedges which leave a regular space round the pipe. After placing the clay fillet, the lead joint is run and set-up without difficulty, and without special precautions to prevent slipping. On the removal of a pipe, the materials may be used again without waste. The collars, which are slightly conical, are driven off by blows from a hammer, and the pipe rolls out. As for the pipes, the only precaution taken by the manufacturer to avoid breakage is to wrap them round near the ends with straw bands. Handling in store and transport to the work soon destroy the straw; but breakages are rarely experienced.

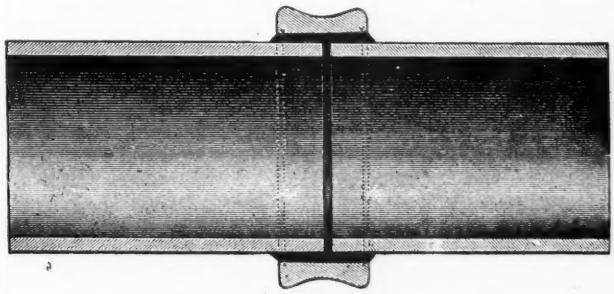


Fig. 1.

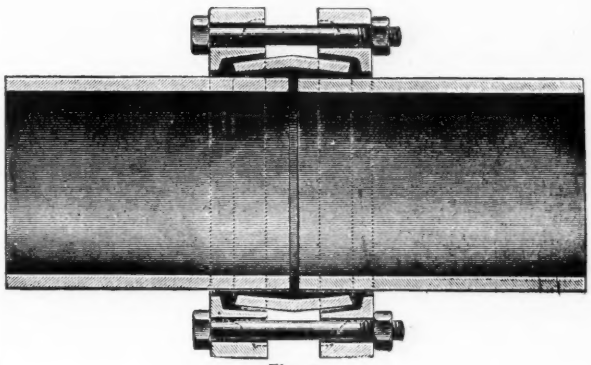


Fig. 2.

Mr. Devonshire says this joint is economical in lead, and is evidently perfectly reliable in cases where the pipes are rigidly supported, and where there is no liability to strain or vibration.

"Armoured" concrete pipes have been largely used in Paris for both sewer and water, and for high and low pressures. M. Vibert furnished the author with a note on these pipes, with drawings of the various forms of joints for high pressure recently introduced by M. Bonna and by MM. Latron and Vincent. (These joints are illustrated in figs. 3 to 5.) The following information is obtained from M. Vibert's note: The length of armoured concrete pipes used for water supply was on the 1st of January last 12,000 metres, or 7½ miles, of which 1800 metres were 60 inches in diameter, 4800 metres 49 inches, and 5400 metres 44 inches. There were in addition 180,000 metres, or 112½ miles, of low-pressure pipes in connection with the sewerage system—these pipes ranging in diameter from 12 to 80 inches.

M. Vibert gives particulars of two systems of pipes used by the City of Paris Water Department—those of M. Bonna and of MM. Latron and Vincent. The former of these two systems is already known in this country; but, as far as the author is aware, the latter has not yet been used on English water-works. The pipes described are especially intended for medium or high pressures, and are capable of resisting test pressures of 60 to 150 lbs. per square inch. The author here remarks that many miles of concrete pipes with steel "armouring" of other systems are used in Paris for low pressures, especially in connection with the sewerage system; these being sometimes in the form of continuous conduits moulded *in situ* without joints, or cast in lengths, usually of 10 feet, with joints formed of double collars of armoured concrete run with cement. The best-known names among

the French contractors who have constructed sewers and pipes for low pressures are Coignet, Chassin, and Bordinave. Concrete pipes, with simple armouring of rings and rods, will withstand pressures up to 30 lbs. per square inch; but above these pressures the porosity of the concrete causes sweating, and it becomes necessary to introduce a water-tight lining into the concrete. It is with this type of pipe that M. Vibert deals.

The Bonna pipe consists of a cylinder formed of sheets of steel from 1 to 2 millimetres in thickness, soldered together by the oxyhydrogen flame, and surrounded on its outer side by an armouring of steel rods of ✝ section arranged in spirals and connected horizontally so as to form a network. The weight and spacing of the rods are calculated to resist the radial pressure due to the head of water to which the pipe is subjected. A second and lighter network of steel rods is placed within the sheet-steel cylinder to serve as a binding for the cement forming the inner face of the pipe. The steel framework of the pipe is placed in a vertical mould provided with a collapsible mandril, and concrete grouting, composed of 800 kilogrammes of quick-setting cement to 1 cubic metre of river sand, is run in on either side of the steel cylinder.

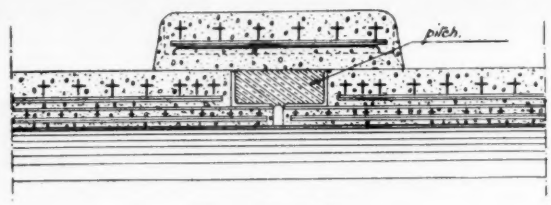


Fig. 3.—Bonna Pipe.

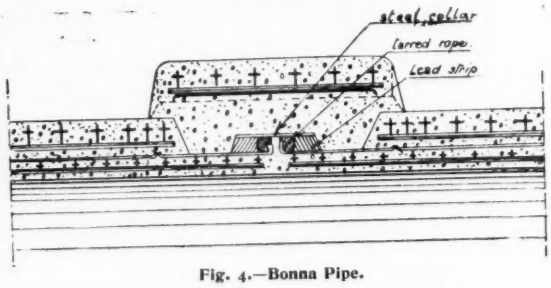


Fig. 4.—Bonna Pipe.

In the earlier form of pipes made by M. Bonna, the ends of the steel cylinder project about 1½ inches beyond the exterior concrete, so as to form an annular space of about 3 inches when two pipes are placed end to end. A double collar of armoured concrete, 8 inches wide, is slipped over the pipe ends; and the annular space is filled by concrete grouting. This joint has been found liable to leak; the water passing between the ends of the pipe and creeping along the face of the cylinder until it finds a weak spot in the surrounding concrete. In the more recent work carried out by M. Bonna, he has obviated this defect by soldering L shaped rings of thin steel on the ends of the cylinder; these rings forming a facing to the concrete (see fig. 3). The space between the rings is filled up with pitch in a plastic or liquid form; and the double collar is then slipped over the joint and grouted with cement. These joints have given good results with moderate pressures; a length of 950 metres laid in 1905 having withstood a test pressure of 52 lbs. to the square inch without any leak of importance. This main has been kept under a normal working pressure of 15 lbs., and is quite water-tight. Other lengths of main of this construction have been found equally satisfactory, except that with a test pressure of 60 lbs. leaks occurred at T-pieces and branches, owing to the deformation of the sheet-steel lining. This defect is to be remedied by strengthening the attachment of the armouring rods at the junction of the branch with the straight pipe, and by increasing the thickness of the steel cylinder at these points.

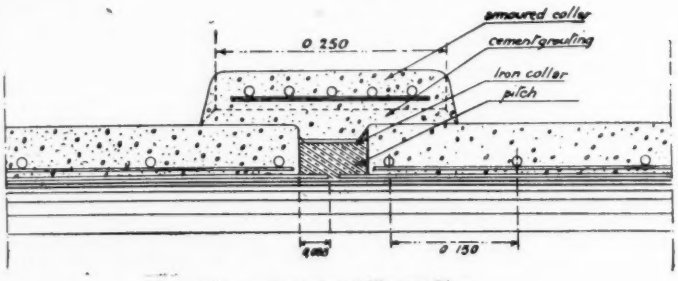


Fig. 5.—Latron and Vincent Pipe.

Referring generally to this particular type of pipes, which are of diameters of 44, 49, and 60 inches, M. Vibert states that during the two years they have been in use one repair only has been necessary. An indication of small leaks having existed at the outset, especially at joints, is shown by the formation of nodules of carbonate of lime outside the pipe. These leaks have taken-up, and the pipes remain perfectly watertight under a working pressure of 15 to 22 lbs. per square inch.

For use as mains for high pressures, M. Bonna has introduced several improvements, especially in the joints. His latest forms of high-pressure joints are illustrated in the drawings which were supplied by M. Vibert. The type of joint selected by the Paris Water Department for high pressures is that already in use in Brussels for a 28-inch main, and is shown in fig. 4. The ends of the steel cylinder, which is increased in thickness to 2 millimetres, carry angle rings turned outwards. Over these is placed a steel collar 4 inches wide. Gaskets of tarred rope are introduced from each side of this collar and packed against the angles, and three strips of lead are inserted on each side of the joint and set-up. The joint is completed by a double collar of armoured concrete; the space above and around the lead being filled, as before, with cement grouting. An order has been placed for 4½ miles of pipes of this pattern —in pipes 49 inches in diameter—to withstand a working pressure of about 120 lbs. per square inch. It is stated that their cost laid, including trenchwork, will not exceed £2 5s. per yard run.

The Latron and Vincent pipe, which is shown in fig. 5, has also been employed in Paris for 1½ miles of 49-inch main for a test pressure of 60 lbs. per square inch. It differs in principle from the Bonna pipe. The steel cylinder is on the inner face of the pipe. It is 3 millimetres in thickness, and corresponds to the theoretical pressure of 60 lbs. to the square inch. The cylinder is formed of steel sheets riveted together and strengthened by an outer armouring of ⅜-inch round-iron rings placed 2 inches apart, and attached horizontally to ¼-inch longitudinal rods spaced at 6 inches. The ends of the steel cylinder extend 1¾ inches beyond the concrete. The pipes are cast in vertical moulds, the concrete being from 2 to 2¼ inches thick and wholly outside the cylinder. The concrete is composed of a mixture of quick-setting cement, sand, and gravel. In making the joint, the annular space of a few millimetres left between the ends of the adjacent pipes is temporarily plugged. The exposed ends of the cylinder are cleaned and painted over with tar. A wrought-iron collar, in two halves bolted together, is placed over the joint, and bitumen run into it; the collar being left in place. The joint is completed by a double collar of armoured concrete filled with cement grouting in the usual way. Of 152 joints, of which the majority were tested to 45 lbs. without the double collar, 9 had to be remade. Other joints leaked slightly at first, but took-up rapidly. No repairs have been necessary during the two years they have been under pressure; but secretions of lime have been observed on the outside as in the case of the Bonna pipes. Their cost is not given. Though adding somewhat to the length of his notes, the author thinks that the information supplied by M. Vibert will be valued for future reference.

The author calls attention to the fact that only 16 million gallons of the filtered river water were pumped into the potable water-mains last year. The whole of this was drawn during the month of December. The prejudice among the population of Paris against the use of any but so-called "spring" water for drinking purposes is very strong, and has been fostered by the attitude adopted by the Supreme Council of Health of France in regard to filtration. Mr. Devonshire points out that the adoption by the Compagnie Générale des Eaux of sand filtration, used in conjunction with the revolving purifier process of the late Sir William Anderson, has demonstrated the fact that Seine water efficiently purified is the purest supply of water in the Paris region, as shown both by analysis and by the more convincing health statistics of the great suburban district supplied by that Company for the last eleven years. It was, however, only with the view of providing a supplementary

supply of potable water in case of a falling-off in the delivery of the aqueducts, that the City Authorities built filter beds at Ivry and Saint-Maur in 1899, following the design of the Compagnie Générale des Eaux in the construction of sand filters, but omitting provision for the most important feature of that Company's system of purification —viz., the Anderson purifiers. In 1906, the Ivry filters were extended and the gravel strainers of M. Puech were adopted in conjunction with them.

Having referred to the systems of filtration inspected by the members on the occasion of their visit—the De Frise, Otto, and Duyk-Howatson processes—the author says that the present situation of the water supply of Paris may be summed up as follows: The Avre aqueduct is of sufficient section to carry 50 per cent. more water than it does at present. Fresh springs have been located, and some already purchased. Several outbreaks of typhoid fever have, however, been traced directly to some of the springs in use; and the bacteriologists have declared that the spring water contains the *bacillus coli*. A medical staff has been appointed by the authorities to watch over the health of the villagers dwelling near the springs; and any outbreak of disease is notified to the technical staff, who endeavour to obviate the pollution of the springs, in which work they are assisted by M. Marboutin with his method of testing by fluorescine. At the same time, public prejudice against the use of river water, principally on account of its comparatively high temperature in summer and the doubts of the Supreme Council of Health as to the efficiency of its filtration, have resulted in placing the filtering stations in quarantine. The only practical remedy for this situation seems to be the purification of the spring water, either by ozonization or by filtration. The spring water is so entirely free from solid or suspendid matter that no film is formed on the filters, and experiments with ordinary sand filters show that they are not capable of retaining the microbes to a sufficient extent. The introduction of a coagulant into the limpid spring water, on which Dr. Miquel made some experiments after a manner of his own, promised good results; and the author believes that the spring water could be purified in the most economical way by this means. In the case of the water drawn from the chalk, a softening process would also most likely give excellent results from the point of view of purification.

Coming to the Compagnie Générale des Eaux, Mr. Devonshire points out that the whole of the water supplied by them is purified by the Anderson process, which was adopted, with the approval of the General Council of the Department of the Seine, after exhaustive trials made at the pumping-station at Boulogne-sur-Seine with plant treating 1,100,000 gallons of water per day. It was constructed in consequence of the success of much smaller plant erected under the author's supervision at the Cail Company's iron-works at Grenelle in 1886. The normal rate of filtration at the Company's works is 88 gallons per square foot per 24 hours, increased occasionally to 100 gallons without impairing the efficiency of the filter. This means that the addition of a battery of revolving purifiers to a plant of sand filters designed for the normal speed of 45 gallons per square foot doubles their filtering capacity, while, as experience shows, increasing their purifying efficiency. Owing to the high speed of filtration, the cost of the purifying plants at the Company's three stations was unusually low in relation to their capacity.

M. Veilhan, the Company's Chief Engineer, supplied to Mr. Devonshire the following information as to the cost of the filtration process from actual experience gained at the various works: (1) The capital outlay, including revolving purifiers and buildings, decanting tanks, sand filters, for an average delivery of 80 gallons per square foot per 24 hours, including filtering materials, and all pipes and drains for raw water, filtered water, and wash-outs—for quantities of 20,000 cubic metres (4,400,000 gallons) per day and upwards, was 14·50 frs. per cubic metre = £2 14s. 4d. per 1000 gallons; and for a quantity of 10,000 cubic metres (2,200,000 gallons) per day, 17·50 frs. per cubic metre = £3 5s. 7d. per 1000 gallons. The cost of the requisite land is not included, and the figures given are conditional upon the ground being suitable for the construction of filters of rectangular form and giving the maximum useful sand surface for the minimum of perimeter of walls. (2) The annual cost per square metre of filtering surface was 5·55 frs. The cost per cubic metre and per 1000 gallons for a quantity of 20,000 cubic metres (4,400,000 gallons) per day is as follows: For amortization of capital, 0·00257 fr. and 0·1285d.; for working expenses, 0·00239 fr. and 0·1195d., or approximately ¼d. per 1000 gallons, including 5 per cent. on capital outlay.

The Company have made extensive use of reinforced concrete in the construction of reservoirs and mains, both in the neighbourhood of Paris and in other of their undertakings. The supply-channels, settling-tanks, and filter-drains at the Choisy-le-Roi and Neuilly-sur-Marne works are of this construction; the latter including 1500 metres run of 1·20 metres diameter (47 inches), formed *in situ*, and costing about 50 frs. per metre (37s. per yard), including trench-work 10 feet deep. M. Chassin's firm have constructed for the Company several reinforced concrete reservoirs of capacities ranging from 200 to 4000 cubic metres; the largest being of circular form with a domed roof. M. Boutan states that these reservoirs cost less than masonry, and have stood very well.

The specially interesting and novel feature of the works of the Compagnie des Eaux de la Banlieue is the plant of gravel strainers and sand filters on the system of M. Puech. Their construction and general arrangement have already been fully described. The author ventures to make some friendly criticisms on M. Puech's process as exemplified at Suresnes. His recent visit to Paris confirmed the view he expressed at Scarborough last year that filtration in this case is really overdone. The plant comprises four series of strainers, a "prefilter" or rough sand filter, and a finishing slow-speed sand filter. Between each of the successive stages of straining and filtration the water is aërated in cascades, with the result that there is a luxuriant growth of vegetation. The clarifying efficiency of the gravel strainers and prefilters is so great that on issuing from the latter the water is perfectly clear. Practically, no film is formed on the surface of the finishing filters; but in the summer time the water overlying the sand in the filters is full of growth floating at the surface or within 1 metre of its depth. An examination of this floating substance shows that it is decaying vegetable matter, and explains the fact that when seen through the colour tubes the water entering the reservoir is less brilliant in appearance than that issuing from the prefilters. From an examination he made, Dr. Kemna concluded that during the last stage of the process the water had deteriorated from the chemical point of view. In the author's opinion, M. Puech's theory is wrong in ignoring the value of the film formed on a sand filter.

M. Chaudoir, the Manager of the Company, has supplied some interesting figures of analyses of raw and filtered water from the Suresnes works made weekly from January to November. Three separate analyses were made of each sample—one (A) at the official laboratory of Montsouris, with 15 days' incubation period, and two (B) at the laboratory of the Company, with periods of incubation of 15 days and 48 hours respectively, The average results of these analyses are as follows:—

—	Average Number of Microbe Colonies, and Percentage Removed.						
	River Water	Water from Puech Strainers.		Water from Rapid Sand Filters.		Water from Slow Sand Filters.	
	Number.	Number.	Per Cent	Number.	Per Cent.	Number.	Per Cent.
A . .	334,150	..	..	..	..	121	99·96
B . {	37,674	3,153	91·6	678	98·0	93	99·80
{	6,066	609	90·0	104	98·3	29	99·50

The author is informed that a special nutritive medium is employed by Dr. Miguel at the Montsouris laboratory; and it would seem that, cultivated in this medium, the microbe colonies multiply enormously and by geometrical progression. Taking the colonies counted after 48 hours as the standard, it will be noticed that the numbers counted after 15 days are increased by 5500 per cent. for raw water and 410 per cent. for filtered water by the Montsouris method, and that as between the two periods of incubation allowed at Suresnes the increase is 620 per cent. for raw water and 320 per cent. for filtered water. This is a very striking exemplification of the necessity of knowing the methods of analysis employed when considering the percentage of improvement obtained by filtration. M. Chaudoir supplies the record of the 18 slow sand filters, which shows that these filters run from nine to twelve months without cleaning.

The author looks upon the Puech strainers as extremely valuable for the preliminary treatment of water containing much solid or suspended matter; and he cannot show his conviction as to its merit more practically than by saying that his Company at Antwerp are now inviting tenders for the construction of gravel strainers at the Waelhem works. As the result of extended experiments made at these works by Dr. Kemna, it has been decided to modify the process as exemplified at Suresnes to the extent described by the author in his paper.

M. Chaudoir has kindly supplied the author with the following information as to the actual cost of working at Suresnes: The staff consists of a foreman, three men for cleaning the gravel strainers, two for the prefilters, and four for turncock's work, sand washing, night work, &c. With various stores, water for washing sand, &c., the expenditure amounts to 3000 frs. per month for 600,000 cubic metres of water filtered, or 0·005 fr. per cubic metre. The expense would be the same for a somewhat increased quantity. To this must be added the cost of the laboratory, amounting to about 1000 frs. per month. These figures correspond to a total working cost of 0·297d. per 1000 gallons. The capital outlay amounts to £100,000, to be paid off in forty years. The engines at the pumping-station are of the horizontal type and similar to those seen so frequently in Paris. They were described in the pamphlet prepared in connection with the visit to Suresnes.

Discussion.

The PRESIDENT said the members were greatly indebted to Mr. Devonshire for his kind explanation of the various pumping-stations and works the members went to see in Paris. He asked Mr. Blackburn to open the discussion on the paper.

Mr. A. B. E. BLACKBURN (Sunderland) said he thought the members owed a great debt of gratitude both to Mr. Devonshire and Dr. Kemna for all they did for them in arranging the visit to the Paris Water-Works, and also for the trouble they took in compiling the notes with regard to the works. The members were under a further obligation now to these gentlemen for having collected together in the paper the lessons which they could all learn from the visit. There was one point which remained on his mind more than any other, and that was the almost universal use of single-cylinder engines. While the members were in Paris, they were unable to obtain any satisfactory explanation as to why French engineers adopted this type of engine; and he thought the members would agree with him that the explanation given by M. Dutoit was not altogether satisfactory. The armoured concrete pipes interested the members greatly, as did also the extensive use made of ferro-concrete in the construction of reservoirs. The sewers were a most interesting feature; and many of the members wished they had such things in England. Personally, he did not see why, in any extension of streets, similar sewers should not be adopted in this country. In the matter of sand filtration, he thought they might all learn something from the French engineers, because they had certainly come prominently to the front in this question.

Mr. F. W. HODSON (Loughborough) remarked that the question of the filtration of the Paris water supply was to him the one of the greatest and highest importance in what they saw during the Paris visit. One point, however, should be kept in mind. The adoption by the French of the fifteen days' bacteriological test made the figures published absolutely incomparable with the figures with which water engineers were accustomed to deal in England. The proposal to filter the spring waters by sand filtration would, unless very carefully dealt with, be liable to great disappointment. It was becoming more and more understood that the filtration of a very clear water was subject to difficulties. One wanted a considerable number of microbes or some organic matter. Another wanted something in the water which, as Dr. Kemna said, would strike with velocity against a stone and stick to it. There was very much in the description of the remarkable action they had seen in the Puech filters. It was the only explanation of the remarkably quick action of the Puech strainers and of sewage bacteria beds; and it was also, he thought, an explanation of the fact that the filtration of pure water was ineffective. He was brought into personal contact with this a good many years ago, when the bacteriological question was in its infancy. He was concerned with the late Sir Edward Frankland and Dr. Turner in dealing with the sanitation of a large public institution, the inmates of which had been suffering from typhoid as well as various other obscure diseases. The whole of the drainage was re-executed, and a new water supply was obtained, some two miles away, from a deep boring in the chalk. These alterations greatly improved the general health of the institution, but still left a residuum which was put down to the water supply. Those were the days when the value of sedimentation and filtration from the bacteriological point of view were just beginning to come to the front; and the consultations ended in a recommendation for the filtration of the water from the chalk borehole. A sedimentation tank to hold about three or four days' supply was put down, into which the water was pumped over a fountain for aëration; and from this tank the water was passed through a large area of specially fine sand, so as to obtain the best results. When the work had all been done, the reports of Sir Edward Frankland on the matter clearly pointed out that the water was worse than before it went on to the filters. This experience he thought would apply to the filtration of the beautifully clear Paris spring supplies which they had seen, unless some coagulant was used. But a double object was obtainable by softening and filtration. The softening process itself would do away with 99 per cent. of the bacteria; and the hardness would be materially reduced from the present figures of 15° and 19°. Thus the supply would be improved in two ways. The other points of interest to him in the visit were the extensive use made of armoured concrete by the French engineers (who evidently had nothing of the nature of our Local Government Board to consider) and the systems of filtration of the suburban supplies. The largely increased rate which could be used in filtration by the adoption of Puech filters was certainly a valuable asset; but he thought the members agreed, when they saw the water, that in this particular instance pre-filtration was carried to excess, and the filtration left to be done in the sand filters was not sufficient. They were creating the conditions he had previously alluded to; and if pre-filtration was carried out to the extent they saw, the water in the sand filters began to deteriorate.

Mr. F. J. BANCROFT (Hull) said, upon reading the descriptions and *résumé* of the Paris visit, there were one or two matters to which he would like to refer. With respect to the single-cylinder horizontal engines, he presumed that the consumption of 3·4 lbs. of coal per pump-horse-power-hour was under ordinary working conditions. If this was so, it might be 30 per cent. above the consumption which would take place under test conditions—the engines working up to the full power. Even allowing for this, he agreed with Mr. Devonshire that it was not a result which would tempt English engineers from double and triple expansion. At the Springhead water-pumping station, at Hull, the triple-expansion engines (which the members of the Association had visited) used 1·5 lbs. coal per pump-horse-power—*i.e.*, a duty of 147 million foot-pounds per hundredweight of South Yorkshire steam coal. Another matter of detail which he noticed was referred to in the pamphlet, prepared for the visit, on the "History and Description of the Water Supply of Paris." It was to the effect that the landlord of tenement houses might contract for a supply at a fixed annual payment, ranging from 6 frs., &c. Under these circumstances, he took it, the tenement property was supplied by meter at a minimum charge; and the arrangement was such as to give the landlord an interest in checking waste and undue consumption, while ensuring to tenants, by the minimum charged, a supply of 12 gallons per head per day. This was a method which might be adopted in England in many cases. But he regretted to say the Local Government Board did not encourage the meter supply for domestic purposes; and by their action in Private Bills they prevented the extension of meter supply in this direction, with the result of large and unnecessary waste and undue consumption. Passing from matters of detail, one of the most prominent characteristics that struck him was the dual supply of Paris. He had divided the quantities given, and found the potable supply amounted to 19 gallons per head per day; and the other supply to 38½ gallons per head per day. For potable supply, 19 gallons per head per day, in his opinion, pointed to the care exercised in its distribution and the restricted nature of the supply for a city like Paris. It would be of interest to know if the river-water mains were confined to the principal thoroughfares, or was the dual canalization complete. If the relative lengths of the two sets of mains were supplied, it would give an indication of the relative proportion of the streets supplied on the dual system. Another

prominent matter, and of the gravest consideration, was that the spring water which was popularly believed to be pure was subject to serious contamination at its source. The members were well aware, from the epidemics that from time to time had occurred in this country in several towns, of the susceptibility of spring water, under certain conditions, to contamination. These conditions appeared to exist in the Paris supply, and to cast the gravest suspicion on it. Under such circumstances, he entirely agreed with the remark of the author that the purification of the spring water, either by a coagulent or by softening, would give excellent results, and, indeed, in his opinion, was absolutely necessary to place that part of the water supply in a satisfactory and reliable position worthy the City of Paris.

Mr. R. O. Wynne-Roberts (London) said he had an opportunity of visiting the Paris Water-Works some five years ago. He did not think the Garche reservoir was included in the list that Mr. Devonshire had given. It was a small concrete reservoir. It was of oval shape, and had a dome roof; and he thought it a very economical design. One of the things that struck him was the thickness of the walls adopted for reservoirs in Paris. The Garche reservoir measured 71 feet long, 52 feet wide. It had a domed roof, rising 12 ft. 6 in. above the floor; and the reservoir held 10 feet of water. The thickness of the walls at the bottom was $4\frac{3}{4}$ inches and at the top 4 inches. The roof was 4 inches; so that the thickness was very slender compared with what one was accustomed to in this country. In the description by Mr. Devonshire of an elevated reservoir, a similar type was shown to him (Mr. Wynne-Roberts). The bottom was 17 ft. 9 in. above the ground; and it had a domed bottom, vertical walls, and domed roof. The thickness of the walls at the top was $4\frac{3}{4}$ inches; and at the bottom 6 inches. The thickness of the roof was $3\frac{1}{8}$ inches. He was merely giving these figures to show how advanced French engineers were in the art of construction in reinforced concrete. In the description of the Paris Water-Works, reference was made to the use of Gibault cocks. He should have thought they would not have introduced these things, owing to the difficulty of keeping them in repair. If they had sluice gates, they could withdraw them for the purpose of removing any part, or rust, or anything that might get in. In the case of these cocks, the wedge shape was always downwards, so that it had to be cut out before inserting a new one. He noticed that Mr. Devonshire said the charges for water were based on gauge-cocks. Curiously, he knew of only one other place—that was Capetown—where water was supplied on a similar basis. He had thought Paris had abandoned the system. He used all his efforts to get it abandoned at the Cape. The method adopted there was to have the same type of cock, with a groove cut along its surface passing from one port hole to another. The groove was made to pass 100 gallons per day, or 200, 300, or 400 gallons, according to the money paid. When arranging for a supply of water, the consumer had to say the quantity that he was prepared to take; and then he paid at the rate of £2 per annum per 100 gallons per day. This was a most troublesome system, and necessitated much supervision and checking. The grooves, too, in the cocks were frequently choked up with silt. Further than that, they could not maintain a constant supply—that was to say, a constant supply of the previously arranged quantity. The supply, too, might be arranged at 100 gallons per day; but very frequently, owing to the erosion of the metal, it would get up to 500 gallons per day. Mr. Devonshire had also mentioned about the dry galleries round the reservoirs. He had seen some of these galleries, and should like to point out that the French engineers had carried this idea further than to dry galleries round service reservoirs. The members would recollect the Bousey dam disaster, when a portion of the wall was pushed out by the force of the water. The French engineers and government departments got uneasy with reference to the other dams, and they pondered over the question to see what could be done to avoid similar disasters; and they utilized reinforced concrete. This was done by building a thin wall of this combined material between the dam and the water, leaving a space of 5 feet. In this space, there were a series of galleries. The depth of the wall was 72 ft. 6 in. and the bottom thickness was $5\frac{1}{2}$ inches, and the top thickness 3 inches. In the depth of 72 ft. 6 in., there were five galleries with steps, so that a person could go round and supervise the whole of the structure. Any leakage would percolate through the wall and gravitate down to the floor, and pass away without any danger whatever. If a similar thing happened to a masonry dam, they well knew what would be the result. With this arrangement, the water was kept away from the dam. The method of cleaning the sand by an archimedean screw called to mind the method the Liverpool Corporation had at the Oswestry filter-beds on the Vyrnwy water scheme. The system adopted in Paris had long been applied there with a slight modification. Instead of having two archimedean screws, the engineer had devised an endless band with scoops which carried the sand to a hopper. From the hopper, it was forced up by an inclined revolving drum—not from an archimedean screw working inside a trough, but the trough itself turned round; and the sand was carried forward to the front. Water flowed in at the top end—in the opposite direction to the sand—and the dirt was washed back. By the time the sand reached the mouth of the pipe, it was clean. The Liverpool people were apparently not satisfied with this arrangement; and so they had devised a different method, which they worked on the bank. The sand cleaners he had described were all placed in the centre of the filters; but the new arrangements were on the sides, and were more portable. Regarding the reinforced concrete pipes, he believed the cost was stated at £2 5s. per lineal yard laid in a trench. He stated that a pipe of similar calibre in cast iron would cost from £4 10s. to £5; so that there was from £2 5s. to £2 15s. reduction by using reinforced concrete pipes. But the drawback he could see was that, whereas in a cast-iron pipe they could take out a piece and insert a T piece and branch at any part, in a concrete pipe it was a matter of difficulty to make connections. Such pipes might be eminently useful for trunk mains from reservoirs, but not for any town work. Therefore, he did not see there was any great prospect of utilizing reinforced concrete pipes in this country in this connection.

Mr. J. Shaw (Boston) was sorry to say that he was unable to go to Paris with the members of the Association; but some 25 years ago he was all over the Paris Water-Works. What struck him, as it had done Mr. Devonshire, was that the whole of the engines were horizontal ones; and at that time they were all worked with Corliss valves, and driven at a high speed. Then British water-works practice was to run pumps at about 80 feet a minute, whereas in the Paris Water-Works the pumps would be run 250 feet per minute; and the pumps at Ivry were running at 200 feet per minute—very much faster than the 3 feet per second which British engineers thought was the maximum that should be allowed in long pipes. The pumps, too, were smaller than were connected with the engines in British works. At that time, also, the Paris people had one of the oldest pumping-engines in the world. It was one that had been put down by Messrs. Boulton and Watt; but it had been re-cylindered and started to work again by a French firm about 1858. It was still at work at the time of his visit. It seemed to him that French engineers must have thought something of horizontal engines, seeing that they had carried out all their new works with horizontal Corliss engines. There was another thing that struck him, and that was the extreme lightness of some of the French work in reservoirs. There was one reservoir at Mountsouris, to the south of Paris. There they had about 1800 pillars supporting the roof. It was a double-decked reservoir, and with a clear span of 3 metres, practically 10 feet. The cover was two courses of $2\frac{1}{4}$-inch pan tiles, set in cement, and some earth on top. With reference to the spring water, he had always been struck by the wonderful brilliancy of the Paris spring water. In some places, they could look in the reservoirs with water 14 or 15 feet deep in them, and see a pin lying on the bottom of the tank.

Mr. Leslie C. Walker (Reading) remarked that he had been very interested in Mr. Devonshire's paper dealing with prefilters, more especially so because he thought he (Mr. Walker) could claim that he came from the place where prefilters originated. The inventor of these filters was his own father, the late Alexander T. Walker. Such strainers or filter chambers were first put down by him in the year 1891. That was some years prior to M. Puech's patent; so that, in this particular direction, he did not think they had a great deal to learn from French engineers. At Reading, they were obtaining now with these filters, chambers, or strainers, a percentage of purification equal to 95 per cent. prior to going on to the sand filter-beds; and their average of percentages of purification for the past fifteen years had been 98·5 and 99 per cent. Mr. Devonshire referred to the

fact that it had now been decided by his Company at Antwerp to construct gravel strainers at the Waelham works; and as the result of extended experiments made at their works by Dr. Kemna to modify the process as exemplified at Suresnes to the following extent: "There will be three groups of gravel strainers, and no prefilter; the sand filters being left to do their full share of the work. There will be no aëration of the water from stage to stage, and the strainer tanks will be covered to exclude the light." That was exactly what had been done at Reading. According to the system carried out by his father at Reading, they had no aëration between the chambers. The water simply flowed from one to the other; and the filters were covered so as to exclude the light.

Mr. DEVONSHIRE, at the close of the discussion, said he did not think there was much to which he could reply. He thanked the members for the interest shown, and for the way the paper had been received. It would be understood that he was not responsible for the facts he had given; and if there were any points any member wished to have elucidated, he should be pleased to get from headquarters exact facts for a reply.

TEMPERATURES IN A GAS-ENGINE CYLINDER.

AT a recent Meeting of the Royal Society, a paper on the "Measurement of Temperatures in the Cylinder of a Gas-Engine," was submitted by Professors Callendar and Dalby.

The authors first pointed out the importance, in the experimental investigation of the internal-combustion engine, of being able to measure the temperature at a suitable point in the cycle. The difficulty of making this direct measurement arises from the fact that during the cycle of operations in the working cylinder the temperature rises above the melting-point of platinum or of any thermo-electric couple which can be used for the observation. Also, since the temperature is changing so rapidly, whatever apparatus is used to measure the temperature must have small mass. Moreover, its insertion in the cylinder of the engine must not alter the volume or disposition of the clearance space; otherwise there will be danger of pre-ignition.

The authors use a platinum wire 0·01 inch diameter and 1 inch long, in conjunction with a compensator of the same diameter and $\frac{3}{8}$ inch long; and the temperature is ascertained by measuring the change of resistance corresponding to the middle $\frac{5}{8}$ inch of the 1-inch wire. To avoid the difficulty experienced by previous experimenters in this direction, the platinum thermometer is screened from the high temperature by placing it in a valve which allows the thermometer to be exposed during any part of the cycle for a suitable interval of time, and to be perfectly protected from the high temperature when the valve is closed. This valve is contrived in the spindle of the admission-valve, and the gear for operating it is clearly shown in the figures in the paper. The advantage of this position is that, as the whole charge of air and gas streams into the cylinder around the spindle of the admission-valve, the temperature of the valve and the thermometer inserted in it are brought continually into approximation during the whole of the suction stroke, so that at the instant that contact is made for the measurement of the temperature—viz., just after the close of the admission-valve—the thermometer and the temperature it is required to measure do not differ widely in temperature. Moreover, at this point in the cycle the rate of change of the temperature is nearly a minimum. In measurements of this kind, it is essential that there should be no missed explosions; and the authors therefore arranged the engine so that this condition should be exactly fulfilled during the whole of the tests.

Experiments were made to determine the lag of the platinum thermometer behind the temperature of the fluid it purported to measure, and the effect of the valve carrying the thermometer on the temperature indicated by the thermometer. The conclusion arrived at by the authors is that the method may be used to give the temperature of the charge at the beginning of compression within 1° C. A few experiments were quoted in the paper, from which it appears that at full load the temperature rises to a point between 2000° C. and 2500° C. when the mixture is rich.

Many of our readers will, we are sure, join with us in expressing sympathy with Mr. G. Clarry, the Secretary of the Cardiff Gas Company, who has lately received news of the accidental death, as the result of a gunshot wound, of his son, Mr. Ivor Clarry, who was engaged as an Assistant-Engineer on the Nile Embankment Works now being carried out by Messrs. John Aird and Co. It is presumed that the unfortunate young man was cleaning his gun after having been out shooting, and that an undischarged cartridge exploded. Mr. George Clarry was desirous of having the remains of his son brought to England for interment; but it appears that the burial had taken place before the news of the sad event arrived.

SOME CONSUMERS' VIEWS ON INCANDESCENT GAS LIGHTING.

[COMMUNICATED.]

CURIOUS sidelights are thrown on the idiosyncrasies of some gas consumers by correspondence which is at the present time proceeding in a desultory way in the columns of the "Manchester Guardian."

The origin of it appears to be a complaint that Manchester gas is neither so cheap nor so good as some who use it think it ought to be. Having regard to the large sums annually appropriated from the gas revenue for the relief of the rates, it is surprising that a greater outcry is not made by Manchester consumers about the price they have to pay. Perhaps they have become so used to being bled that they no longer feel the soreness of it, and do not appreciate the injustice of the man who burns gas being called upon to pay part of the rates of his neighbour who uses some other form of illuminant or none at all. What does appear to affect some of them is the fear that the quality of the gas may not always be what it has hitherto been. It is in vain to assure them that a high illuminating power is of less importance than in the old days when there were no incandescent burners. As a matter of fact, there are people who have not yet taken to incandescent lighting, just as half-a-century or so ago there were those who did not appreciate gas, and longed for a return to the dimness of the candle light to which they had been accustomed in their youth. The objections to incandescent lighting on the part of these worthy people are perhaps trivial. Nevertheless they are worthy of attention, because they possibly represent a not inconsiderable body of opinion which does not find expression. One gentleman says that he has more than a dozen incandescent burners in use, and about the same number of flat-flame burners to which it would be a nuisance to apply the incandescent system. Why it is a "nuisance" does not appear, though it is not improbable that the occasional attention which incandescent burners require is the cause of the trouble. Certainly the old flat-flame burner, which seldom went wrong, rarely needed renewing, and made no particular demands for care in its use or skill in fitting or cleaning, had a charm for the man who does not like to be troubled, and considers a "nuisance" any new call upon his time or his skill.

But the consumer who makes this particular complaint, whatever its grounds may be, would seem to have not one-half the grievance which afflicts another, who, however, does not use Manchester gas, for he says it is many years since he lived near enough to the city to do so. He writes in most dismal strains of his experience with incandescent lighting. He has tried it, he says, at Altrincham, Southport, and Colwyn Bay, and in none of these places has he achieved perfect success. The great cost of upkeep in mantles and chimneys is one cause of his complaint. "I have now," he says, "between 60 and 70 lights, mostly incandescent; but with these, as with their predecessors, my determination has often been to dismantle all and go back to the common burner." It is unfortunate this correspondent does not afford a clue to his present address. Apparently his is a case in which a little advice and counsel from someone who is really skilled in the management of incandescent burners might be of good service.

There are many such instances. It is not everyone who knows how to fix and regulate burners, which are the best and cheapest mantles and chimneys to use, and how and when to clean the burners from the dust which tends to clog the fine orifices through which the gas issues. When failure dogs a man's footsteps as it has done in the case of this unfortunate person, it is not unnatural to wonder how much of it he is himself responsible for. It is a pity, at all events, that he cannot be placed in communication with the manager of the gas-works in the district where he lives, or with someone who might convince him, by practical demonstration, that the evils of which he complains are not incurable.

Another correspondent goes off on a different tack, and suggests what may possibly prove an interesting subject of inquiry. Starting off with the admission that the incandescent gas-light is a splendid illuminant, he nevertheless finds fault with it because, after sitting under an incandescent light for any length of time, he has "experienced a nasty acute odour, accompanied by smarting of the eyes." This leads naturally to the suggestion that there is something deleterious in the products of combustion from an incandescent burner, which is not to be found in gas consumed under other conditions. It is very improbable that there is anything of the kind. What is more likely is that there is something in the temperament or bodily condition of this sufferer which leads to these sensations. Different individuals are affected by quite ordinary things in many different ways; and it is possible that this gentleman is peculiarly susceptible to conditions produced by the rays emanating from incandescent gas-mantles. At all events, his experience appears to be unique. The difference in the effect upon the atmosphere of a room from the use of flat-flame and incandescent burners must be very small, with the advantage, if any, on the side of the incandescent burner, because of the smaller consumption of gas which it calls for. Still, there are this gentleman's sensations to be accounted for, unless they are to be dismissed as mere fancies.

ILLUMINATING GAS FROM COKE-OVEN PLANTS.

By Archibald S. B. Little, of St. Louis, U.S.A.

From time to time we are confronted by facts and figures, relating to new processes in gas manufacture, which seem to bring us to an abrupt stop in our manner of contemplating the industry, and cause us to wonder if the established route we have followed persistently, to such good end, is altogether the right direction to follow. When we come to look without bias on our mode of work, it seems wonderful that such really excellent results have been achieved, because there can be no doubt our methods of manufacture, elaborated though they are by the use of carefully designed machines, are nothing more nor less than a copy, on a larger scale, of the main idea of Murdoch. In other words, we have adhered to the process of intermittent manufacture of gas in small retorts, which are nevertheless heated differently and more economically and charged with less labour and expense. There is still a great loss of gas caused by the frequent opening of the sealed vessels; and the unit heated by one furnace is still very small. To a great extent we are dependent on a limited number of fields for our coal supply, as the whole of the gas made must be marketable for illuminating purposes; and this means, owing to the small number of collieries and the restricted output, a high price for the chief raw material used. As existing mines travel towards depletion, the price is most likely to increase.

Who that has noticed the huge stocks which accumulate on coke yards during certain periods of the year will not admit that it would be a grand thing if this portion of a gas company's output could be turned from a bye-product into a primary and marketable object of sale? That this desideratum can be achieved has been proved; and in this article the writer proposes to show the methods adopted of making illuminating gas and yet which gain a hard coke that is free from the soft, spongy attributes of the coke turned out in ordinary retorts, and which has the quality of hardness that serves to make it suitable for consumption in domestic stoves and ranges, blast furnaces and cupolas.

Before going into a description of a new process, I will point out one or two more reasons why gas, as at present made, entails a certain amount of cost which, so long as we adhere to existing ways of manufacture, is inseparable from its introduction. One of these is the cost of maintenance; and this is especially a serious item out here in the United States, where the labour is fierce in quality, and the treatment of retorts and furnaces is abominable. If one were to try and find out wherein lies the source of the extra cost in manufacturing gas out here, after putting on one side the well-known fact of excessive charges in promoting and capitalizing a company, the finger could be put on the next and most important item by right away referring to the charges for repairs and maintenance. One need not look outside the retort-house either. Apart from the automatic and unavoidable damage caused by frequent opening of retorts, the use of rakes and scoops, handled without care, causes a great amount of damage; and no matter if we take the average American life of a retort at from 18 to 24 months, or the English retort at 36 to 48 months, the cost of repairing is very high—in fact, in but few industries could such an expenditure be kept up and yet leave the companies commercially successful. What is the reason for repairs being so costly? It is simply owing partly to the nature and action of the material under fire, the frequent decarbonizing of the retorts, and the high cost of renewing the whole furnace and setting if even only one retort gives out. In a recent article in the "Journal,"* particulars were given of a self-supporting setting, which might allow a retort to be renewed without necessitating the demolition of the whole structure and the renewal of every part. Another way is to build the retorts of tiles. But this latter does not get over the difficulty, because the first cost is great, and it resolves itself into less frequent renewing at greater outlay. It seems then that we should try and get something that is not a one-piece retort—that can be renewed in sections without disturbing the setting, and that will last longer under natural conditions, while at the same time being immune from the destructive propensities of the average unskilled human who operates it.

Perhaps it is as well to say that the writer is inseparably connected in business with the gas industry as at present constituted, and can gain nothing from a change in the style of working; so it is evident that the subject under review is approached entirely without bias, purely in the interest of the gas industry irrespective of personal gain or loss. We must examine closely, from day to day, anything new that comes out as affecting our business; and even if, on most occasions, such diagnosis of our system proves its health, and leaves the members of the profession to jog along in the even tenour of their way, still we must not hesitate to again and again examine new doctrines whenever they are advanced.

Some time ago the "Journal" devoted considerable space to the question of gas making in coke-ovens, and re-published the paper read by Dr. Schniewind before the International Engineering Congress at Glasgow in 1901. Since that time great developments have taken place; and the writer proposes now to examine carefully what progress has been made with the Otto-Hoffman system. At this point, attention may be called to the heating system in our existing coal-gas benches. In a few places there have been attempts to make one large unit as a producer, and convey the gas in pipes or culverts to the several furnaces under the settings—one notable example being at the Dawsholm Gas-Works, Glasgow, where the late Mr. W. Foulis adapted this system with excellent results. In this particular may here be recalled some well-chosen remarks of the late Sir William Siemens, to whom personally, in a marked degree, the gas profession is greatly indebted for a considerable portion of its success. Among other things he said: "I am bold enough to go so far as to say that raw coal should not be used as fuel for any purpose whatsoever, and that the first step toward the judicious and economic production of heat is the gas-retort or gas producer, in which coal is converted either entirely into gas or into gas and coke, as is the case at our ordinary gas-works."

Now, bearing in mind these words, it is a question if we go far enough in this direction, even in gas-works. It is true we have gaseous firing of our benches; but perhaps the method is only a step in the right direction. We use very small units on a large plant; whereas we might make quantities of gas in a huge producer, and lead it just where it is needed for burning under the retort—in this way reducing to a great extent the damage caused to the number of furnaces by the mechanical operation of the coke and by the fierce attacks of the clinker and spear bars. It seems reasonable to expect that some such arrangement would greatly reduce the first cost of plant by making the benches shallower and allowing a more judicious and economic disposition of the regenerator flues, while at the same time causing them to envelop and insulate the bench in the able way described by Mr. Newbigging. The other alternative is to make two kinds of gas in the coking operation, as is done in bye-product recovery coke-ovens; and this will be described in detail later on.

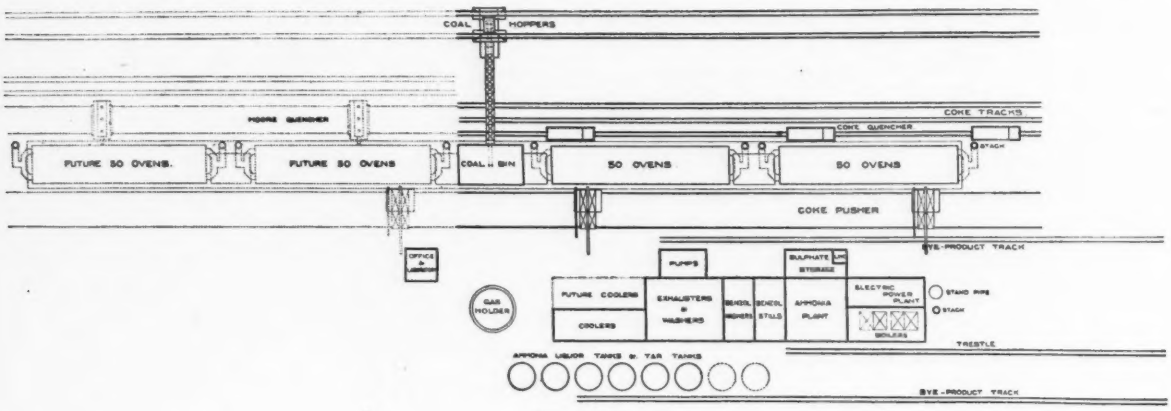
One reason, doubtless, for the lack of attention given to the production of gas on a large scale at (say) the mouth of the pit, was the alleged and expected difficulty, not to mention cost, of the conveyance of the gas over great distances to the point of consumption. Now that we are beginning to realize the heretofore unrecognized possibilities which follow the distribution of gas at high pressure, the chief cause for apprehension will likely disappear. The coming system of conveying gas easily over distances of 300 miles and so on, at a pressure of (say) 250 lbs. per square inch, as is done at the present time in the United States with natural gas, makes the problem not so difficult as it looked; and it behoves us to examine carefully all such propositions as tend to decrease the cost of gas, and remove works to a site many miles distant from our cities. To get a correct view of the whole subject, we cannot do better than review the work done, during the last fifteen years or so on coke-oven plants which also make a feature of the supply of illuminating gas.

It was about the year 1771 that Goethe found Stauf in a little hut near Saarbrücken, endeavouring in his "connected row of furnaces" to "cleanse the coal from sulphur for use in iron-works." The failure of this plant seems to have discouraged other experimenters, as it was drawing on to 1855 before three German engineers successfully operated coke-ovens that allowed of the saving of the ammonia and tar. Later on, Carvés made the real step in advance towards the essential bye-product recovery oven when he added his system of side flues to the Knab design, though it took 27 years before there occurred the making of ammonia and tar successfully in conjunction with the production of coke. This brings us down to about the time plants of this kind were supplying much of the illuminating gas for the City of Paris, when, in the same decade, Huessener, in Germany, and Coppée, in Belgium, were engaged on the design of improved flues for the ovens. The former had horizontal side flues, and the latter vertical; and these formed the pioneers of the two distinctive types of to-day—the Otto and Semet-Solvay.

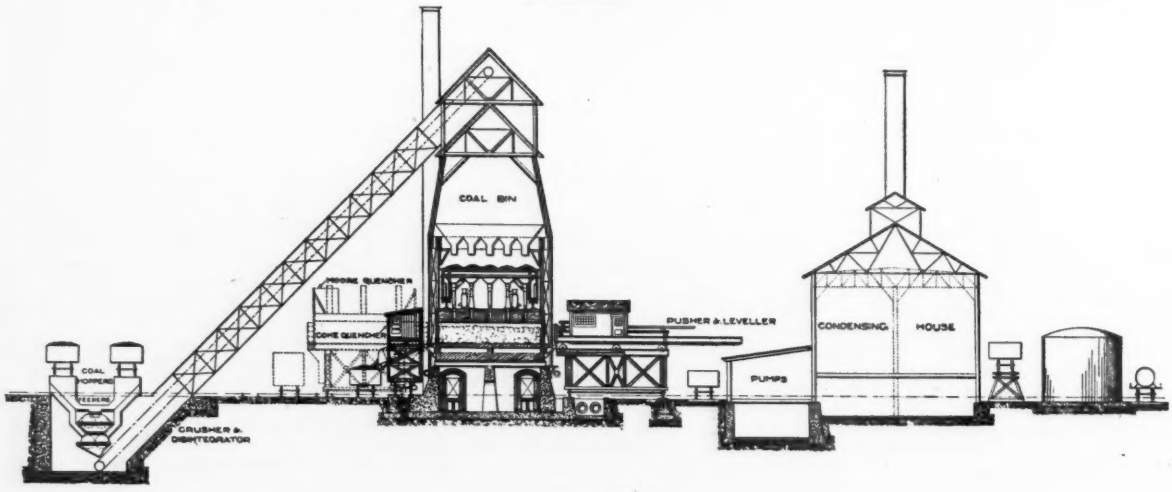
In America, the standard to-day is the old-fashioned bee-hive oven, which is radically different from the recovery oven mentioned above. Its main features are shown on the drawing reproduced on p. 37, which is taken from an illustration published in a paper by W. H. Blauvelt. The oven is dome-shaped, with a flat floor, and measures about 12 feet in diameter by 7 feet high. Through the hole in the top coal is charged; and the coke is raked out of the doorway in the side. Sometimes the ovens are built in double rows; and usually there is a track over the top, along which travels the car in a position to dump coal right into the oven. About 6 tons of coal forms a fair charge; and it is fired by the heat stored in the brickwork from the previous charge—the combustion being over the charge and regulated by air entering over the top of the door. In this system, a small portion of the fixed carbon is consumed along with the volatile matter; the percentage being high when coals which contain a low average of volatile matters are used. The products of combustion pass out at the charging hole in the roof of the oven. In this old-fashioned oven the coke is quenched before it is drawn; and this, in the absence of air, gives it the silvery appearance which formerly made it seem superior to retort-made coke. A bee-hive oven will make, as a rule, about 60 per cent. of coke from the weight of coal put in, at the rate of 1½ to 2 tons per day—48 hours being the least time the process occupies.

It is evident that this way of making coke is wasteful, and not to be compared with the new retorting process. At first, the new scheme was not considered feasible; and in the United States it took years to get the plan to appeal to colliery owners and steel-plant operators. The adoption of a plant, eventually, was almost a necessity; and yet I do not detract from the business instincts

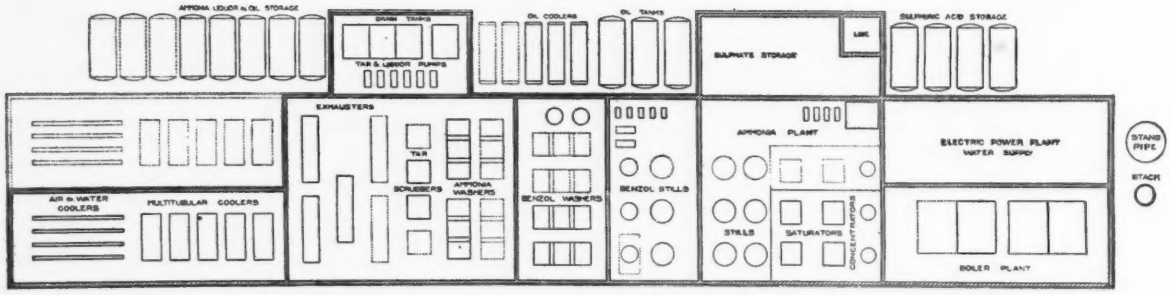
* See "Journal," Vol. XCVIII., p. 25.



Ground Plan.



Sectional Elevation.



General Arrangement of Condensing and Ammonia Houses.

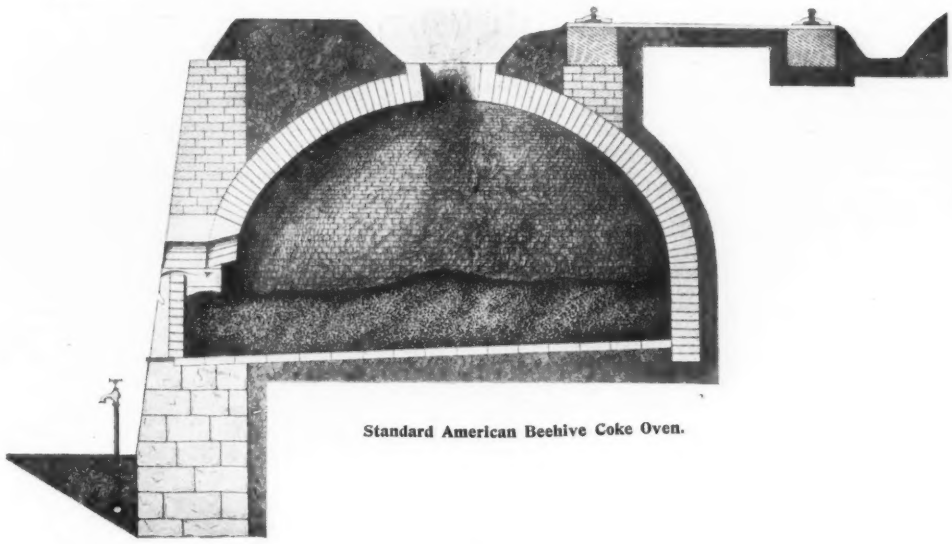
United-Otto Coke Ovens—100 in Number, with Provision for Doubling.

of American engineers in making this statement. They were anxious to try the new scheme; but the magnitude of the task somewhat dismayed them, especially considering the possibility of their coal being unsuitable, which would have meant a very great wreck of capital. I mention this matter, as a similar necessity may confront gas engineers; and it will be useful, should this eventuate, to know and appreciate the methods and initiative employed by coke makers.

The Cambria Steel Company, of Johnstown, Pa., were the pioneers of the new system in the United States. Their idea had no reference to the manufacture of illuminating gas; but this subject was developed as the plant began operations. They were confronted with difficulties which are surely equal to those a gas engineer would have to face if he contemplated the use of the system for making illuminating gas. They had a splendid and easily procurable supply of coal of low volatile value, and of doubtful quality for coke making, as in the latter case it was known to swell so much that its production in retorts was likely to prove impossible. Nothing remained but to take courage and try the arrangement; and with commendable pluck the Steel Company ordered sixty ovens, in two batteries of 30 each, with a complete plant for the treatment of the gas and recovery of tar and ammonia. From the very start success crowned the system, and coke was produced from a seemingly unsuitable coal. All this was done with the Otto-Hoffman oven, which is heated by vertical flues arranged in combination with the Siemens regenerative system. As a matter of fact, the system bears a striking resemblance to our own retorting process, as the destructive distillation takes place in the same way, but is continued sufficiently to get a hard coke comparatively free from sulphur.

In the usual way the rich gas passes to a main, and is thence conveyed to the condenser house. There are two mains—one for the rich gas, the other for the poorer gas subsequently evolved. The former is capable of being used for lighting purposes, in either flat-flame or incandescent burners; while the latter is employed for burning under the ovens—being conveyed thereto by the distributing mains, by means of alternately working burners. Air to complete combustion is taken through chambers connected by a cross flue at the end of the battery, returning from this point through passages by the aid of a fan, and passing thence under the checker-bricks in the regenerators, *viâ* the longitudinal flue. Up to the regenerators the heat of air is raised to close on 780° Fahr., and beyond this point is further increased in temperature, so as to enter the combustion chamber at about 1600° Fahr. One essential difference in the plant compared with our usual recuperative beds is the alternate heating of each half of the oven, which is so arranged that half-hour periods of burning are worked on each half. It is claimed that careful attention to this feature greatly increases the efficiency of the oven and leaves a larger proportion of the gas available for both outside illuminating and heating purposes.

It will be asked, What is the calorific value of the two kinds of gases? Generally, the fuel gas is equal to 550 B.Th.U. per cubic foot, and the richer or illuminating gas approaches generally 700 B.Th.U. The product is used as to about 50 per cent. of the volume for heating the ovens; and the total amount given off varies with the kind of coal used, but is nearly always over 9000 cubic feet to the ton (2000 lbs.). There is not the slightest doubt about these ovens being entirely successful coke makers. At first it was almost impossible to get rid of the 48-hour coke made; but



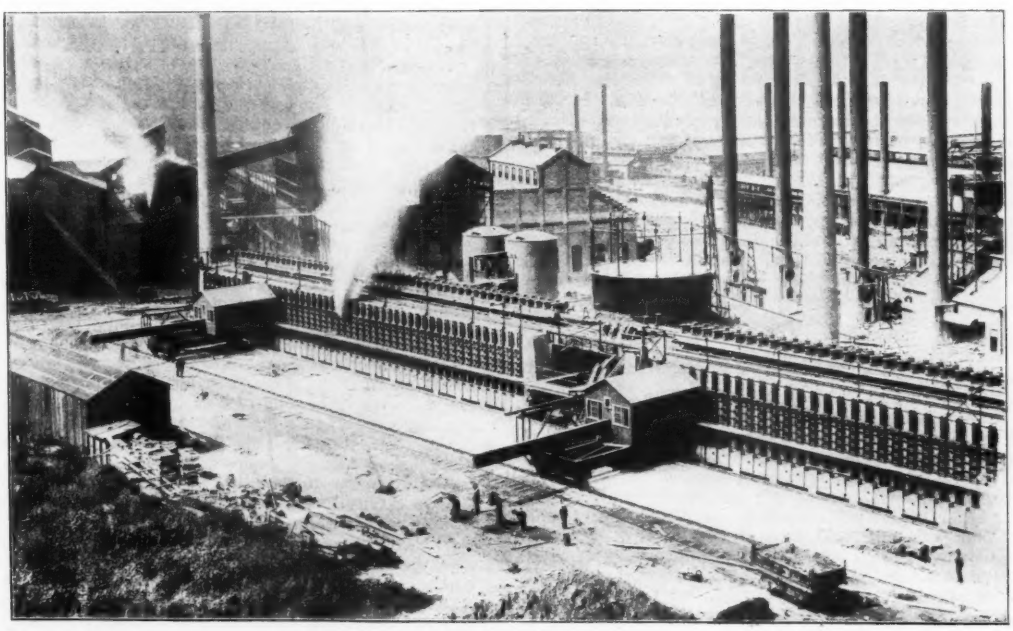
Standard American Beehive Coke Oven.

by the adoption of crushers and sizers, this product was made suitable for domestic purposes, as I shall show later on. The 72-hour coke for manufacturing purposes is also first class in every respect. However, the point which most interests is the production of illuminating gas in the ovens as a sort of side-issue, but in sufficient quantities to make the usual size of plant a carbonizing unit of considerable magnitude. To this end, I will review what has been done in America during recent years.

Following the success of the Cambria steel plant, the Construction Company decided to put in a plant to demonstrate its possibilities for blast-furnace work. A site near Pittsburg, Pa., was chosen, where an installation was put in consisting of 120 ovens, each with a capacity of about 6 tons of coal, complete with bye-product recovery plant. In this installation was inserted the special feature of separating mains for the poor and rich gas occluded from the coal; and the arrangement of double mains previously alluded to was built. In the first 12-hour period of working, the rich gas is taken care of by a main provided with stand pipes and valves; and during the balance of the time what poor gas is given off goes to the companion poor-gas main. The two qualities of gas, illuminating and heating, are kept separate in special apparatus right up to, and including, the ammonia extraction. Following a very lengthy run of this plant, which demonstrated its practical utility as a manufacturer of good-quality illuminating gas, a company was formed in New England, and plant was built capable of converting about 2000 tons of coal per day into a smokeless fuel for use principally on the railroads, and for making domestic fuel to meet the demands of Boston (Mass.) in competition with the anthracite coal formerly used in household stores.

The feature to be noticed principally was the incidental use of the rich gas for illuminating purposes in the City of Boston. Almost simultaneously with the building of this plant was the construction of a large one, on similar lines, in Cape Breton, Nova Scotia; but as all the gas is used for fuel purposes, I need not particularly discuss its arrangement. Another contract was taken for a 50-oven plant in a town which operated a Municipal Gas-Works; but I am informed that the gas from the former was so much superior, and cost so much less, that the Municipal plant was put almost entirely out of business. The pioneer plants mentioned above all met with more than the usual success, and since they were put in have shown the way to a number of companies, who have installed ovens in many States.

There is no doubt that, apart from the coking process, all the plants which were designed for the use of some of the gas for illuminating purposes have been very successful. Hitherto gas engineers have had erroneous views about the value of the system—charging that the method of obtaining gas is too expensive, and, furthermore, stating that the quality of the gas obtained is inferior to that got from a good gas-bench construction. It is because we may be working in the dark in these assumptions that the writer has carefully taken up the subject from a gas engineer's point of view. In the first place, it is found there is a complete line of demarcation between the processes of producing coke and gas, not to speak of the recovery of bye-products. In a previous article, I dealt with the distribution end of the first portion of the plant installed at Camden, New Jersey, and showed how gas was conveyed at high pressure over a distance exceeding 50 miles to supply twelve towns which all had previously in use up-to-date gas-works. To supplement information then given, it may be remarked the manufacturing plant covers a space measuring about 1000 feet by 500 feet, and comprises 100 ovens of the Otto-Hoffman type, mechanical charging and pusher-discharging machinery, condensing apparatus, pumps, washers,



Third Instalment of 100 Coke-Ovens at the Cambria Steel-Works, Johnstown, Pa.

purifiers, &c.; plant for recovery of ammonia previously given up in the form of liquor; tar wells and tanks to contain 90 days' supply; auxiliary gasholder for storing and governing the supply of heating gas to the ovens; storage tanks for ammoniacal liquor, benzol-house, laboratory, and offices.

The writer, having been actively connected for thirteen years with the manufacture of conveyors and elevators for mechanically handling materials, can honestly pay very high tribute to those responsible for the arrangement of machinery for handling the coal and coke on these oven plants. Here is a comparatively new industry, operated by men who have adopted labour-saving transport machinery quite as extensively as, and with insight and foresight equal to, their *confrères* in the older branch of gas making. With the exhibition of such a go-a-head and complete policy in this department of manufacture, it leads one to think there are men at the back of this business who have a thorough grasp of the economic conditions necessary for complete success in any undertaking; and it follows that the inference is, if in this section they are in the front rank as engineers and commercial men, they are also likely to be well to the fore with thoroughly good methods of construction in all concomitant branches. If only for this reason, the contentions of the builders and users of these plants require careful consideration by those brother engineers whose business is likely to be affected by the aggressive action of these new-style gas manufacturers.

The arrangement of the Camden plant is shown, and is in great contrast to the old style of oven where the coke is pushed on to platforms and handled into cars by purely manual labour. In later plants this economical feature in handling the coal and coke is even more marked. From the first illustration of the bee-hive oven, the great contrast in the methods is instantly observed, when we look at the way coal is charged into the ovens from the lorry or truck, down the movable spout which commands the inlet hole in the top of the oven. Great improvements have been made in the superstructure of the plants; and it is interesting to note that the lines followed every day bear a more striking resemblance to those rendered familiar to us on our own benches. One great improvement has been carried out on the regenerators, which previously were made to support the ovens proper, but are now relieved of this function, though placed in substantially the same position. This is an apparent advantage, owing to the doing away with uneven strains formerly put upon the regenerators by the contraction and expansion of the ovens.

Another minor alteration, which nevertheless is a great improvement, is in the pusher arrangement for charging the ovens. This consists of a levelling device to regulate uniformly the amount put into each retort at every stroke; and working in conjunction with this, to the same end, is a mechanically-hoisted door, which is operated by the ram, and is a great advance upon the old style of door, which was raised by a hand-winch running on tracks laid in juxtaposition to the ovens. As a rule, on later plants, the coke that is pushed out falls directly into a generating machine made large enough to accept the whole of the charge in an unbroken state. The quenching arrangements are very complete; but for obvious reasons a detailed description of them cannot be entered into. Suffice it to say the amount of water to be used is found out by practice; and after that the quantity is never varied.

The coke in the quenching machine can be discharged immediately through bottom doors into one or several railroad trucks underneath, which means a great saving in time, labour, and breakage account. In this arrangement it need not be said the production of coke is kept quite distinct from the other processes, of which it is entirely independent, with the exception of the heating process by the use of gas. This heat is externally applied, as before shown, and does not entail loss in consumption of the coke as in the bee-hive oven. Another essential difference between the two systems is the manner of taking off the gas. In the old ovens, this is sheer loss. Herein commences the main difference in the two plants; therein is found the approach to usual gas-making operations. In some places, especially in England, a sort of hybrid arrangement obtains, wherein the gas given off is taken from the ovens and led direct under the combustion chamber; the difference from the bee-hive plant being that in the latter this gas is allowed to escape into the air. It is seen in this English arrangement that there is an entire loss of the bye-products, although the plant is a great improvement over the old bee-hive process. The expense of the plant for the recovery of bye-products is eliminated; but it proves to be disastrous from a financial aspect.

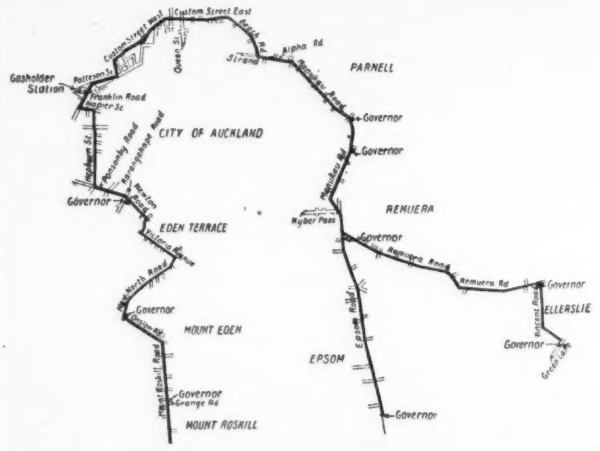
Death of a Friend of Murdoch and Watt.—The death occurred a few days ago, in his 86th year, of Mr. William Brown, an old employee of the firm of Messrs. Boulton and Watt, of Soho, Birmingham. Deceased entered the service of the firm at a very early age; and when the factory was disbanded, half-a-century or more ago, he moved with other employees to the foundry at Soho. He became an experienced engineer, and shortly after the Crimean War was sent to Moscow to superintend the erection of engines for the water-works in that city, and subsequently to Dresden. He knew well both James Watt, the son of the inventor, and William Murdoch, and attended their funerals. As a young man, Murdoch was in the habit of inviting Brown to his house to assist him with some of his experiments. Deceased was the last of the Soho worthies.

HIGH-PRESSURE GAS SUPPLY IN NEW ZEALAND.

By F. Chenery Suggate, Assoc.M.Inst.C.E.

Since writing the description of the new Auckland Gas-Works,* the high-pressure gas supply to Lake Takapuna has been completed, and works very satisfactorily. I have been asked to give some further details of this system, and of the town supply, and thought it might be of interest to your readers.

All thinking gas engineers must realize the important part that high-pressure gas will take in the lighting of the future—not only because it admits of lighting small places within some miles of the gas-works, but because it can be done in a way which makes it a commercial as well as a practical success. I have adopted two distinct systems—one in which the gas is delivered at the gasholder pressure of about 6½ inches into the immediate suburban districts through mains of comparatively large size; the other in which the gas is pumped at a pressure of several pounds through mains of small size.



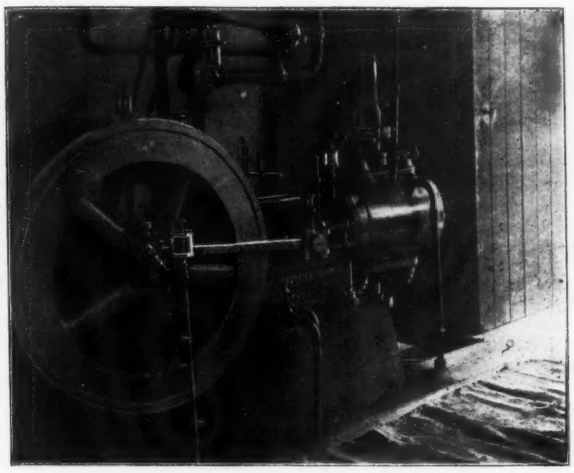
Some years since, the great increase in the consumption of gas in certain local districts opened up an important question as to how to supply the demand efficiently at the least possible expense; it being desirable to also supply Ellerslie, a flourishing district 6¼ miles from the gas-works. A main sufficiently large to supply that district, and the intervening suburbs, would have been an expensive matter. From the new gasholder site, which stands at 9 feet above high-water mark spring tides, the only course for the gas was over a hill nearly 300 feet high, with branches leading down to Parnell and Remuera, some parts of which are lower than the holders, but comprise houses with consumers, containing gas cookers, heaters, and califonts. Calculations proved that at ordinary pressures of 2 or 3 inches, larger mains would be required—possibly an 18-inch part of the way, and further on a 12-inch pipe. Now the former, when laid, costs about 29s., and the latter, 21s. to 22s. per yard. The existing pipes are 12-inch, 9-inch, and 6-inch. I decided upon the less costly plan of putting the full gasholder pressure into these mains for a distance of 5½ miles, after fixing underground governors on the branches, and assuring myself that the pipe-joints would stand the extra pressure. In this way we saved over £1000.

It is now about four years since the alteration was made, during which time these districts have been efficiently supplied with but little trouble. The governors are inspected every month, and their inlet and outlet pressures recorded. Some little trouble was experienced at first by the top chamber of the governor filling with heated air on the removal of the cover during a hot day, and later on cooling—creating a sufficient vacuum to prevent the diaphragm from falling, and thus decreasing the flow of gas. As soon as the cause was discovered, I had a vent-pipe fastened to each cover, carried along the ground, and up the nearest fence Since then we have not had the slightest trouble in any respect. There is also a further great advantage with this arrangement—that if at any time the consumption increases, it can be supplied at a comparatively small cost for pumping plant, without in any way interfering with, or enlarging, the mains.

On the south-west side of the town, the consumption of gas has so increased that I decided to adopt a similar system for a distance of over three miles. The specials and governors (made by Messrs. Sugg and Co.) are now on their way out, and will I hope be laid and working before next winter. The arrangement is plainly shown on the plan.

At Devonport, on the other side of the Waitemata Harbour, the Auckland Gas Company have a separate and complete gas-works, turning out about 27½ million cubic feet per annum. It is at these works that I erected the compressor to force the gas to Lake Takapuna, a distance of about 3 miles. The intervening district is practically void of consumption. The few consumers could, of course, be supplied through high-pressure service governors; but this would necessitate continuous pumping, which extra expense,

* See "Journal," Vol. C., pp. 169, 237.

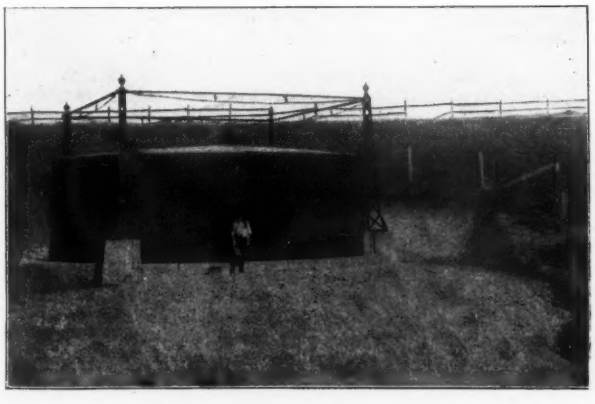


Compressor at the Devonport (Auckland) Gas-Works.

although small, is not warranted at present. The compressor (made by the Rand Drill Company, of New York) has a displacement of 81 cubic feet, and is steam driven. The steam piston is 6 inches in diameter with a 6-inch stroke; and the compressor 10 inches in diameter. The gas is pumped into a cylinder about 2 ft. 9 in. diameter, 10 ft. long (this cylinder we had in stock), and thence through the main direct into the gasholder, a distance of 5115 yards away. The main is composed of 2-inch steel pipes, specially ordered and tested to 250 lbs. per square inch before leaving the mills.

It being necessary to coat the pipes with some preservative which will not readily knock off in handling, I decided to make up a solution composed of half bitumen and half boiled tar, mixed together, and brought up to boiling point prior to the pipes being placed therein. I found that the material adhered perfectly if the pipes were warmed prior to being put into the solution. The pipes were, therefore, allowed to lie in the hot sun, or were artificially dried before putting them in the bath. We riveted together plates making a U-shaped trough, about 20 feet long, and of sufficient capacity to hold about a dozen pipes—the ends being first stopped with plugs of special shape. The bath was heated with wood or coke along its whole length; and the pipes, after treatment, were inclined over a specially prepared floor, so that any drippings were collected and returned to the trough. The solution adhered so tenaciously to the pipes that very little flaked off with the application of the tongs. If this occurred, a little hot solution was brushed over the part.

The gas is pumped into a gasholder, 30 feet in diameter and 12 feet deep, contained in a concrete tank. The holder was one I took down from Devonport—being too small for its requirements. We added 2 feet to the depth—necessitating raising the standards as shown in the photograph.



The Relief Holder with its Heightened Standards.

The present cost of pumping is practically nothing, being done by the foreman in conjunction with his other duties, and the small amount of extra steam used costs very little.

The gas after compression to 5 lbs. per square inch shows no perceptible deterioration in illuminating power. The terminal pressure is 30-10ths.

When starting the compressor I was able to make some interesting experiments as to the actual amount of gas passing through a given pipe at different initial pressures.

As the efficiency of an incandescent light is improved under high-pressure gas, when the consumption warrants it, the main just laid will be capable of taking up this extra duty at very little extra cost, and thus with a great saving of capital.

I have purposely refrained from mentioning any costs, as where labour is so high as it is in New Zealand the ultimate cost must be also high, and hardly realized by English readers. I may, however, say that the installation was completed at a cost of about £50 under my estimate, and at a considerably less price than could have been done in any other way. It would have been some years before the consumption could have reached a payable amount, had the extension been confined to the ordinary system of low-pressure supply.

Pumping at a pressure of 5 lbs. per square inch, and allowing for the increased temperature of the gas due to pumping, the actual amount passed per hour was in excess of any of the well-known authorities on the transmission of gas through pipes—so much so that I refrain from publishing the amounts till further verified.

Next month [December] I shall complete another similar high-pressure system to Otahuhu—10 miles from the gas-works—which will give me an opportunity of making further tests.

EXPERIMENT IN ROAD-TARRING AT BILBAO.

In July last, some of the streets in Bilbao, with regular traffic and having slight gradient, were tarred with unrefined tar from gas-works; and particulars of the operation were given recently in "Revista Minera." The boiler utilized for the purpose cost 777 pesetas set up in the city, and the tar approximately 13 c. per litre—1½ litres being applied per square metre. A month previous to laying the tar, the streets were repaired, reballasted in some places, and levelled in others; a steam-roller being employed until the commencement of the tarring. Before applying the tar, all dust was removed—from one section with brooms, and from others with water under pressure. In spreading the tar, it was found that in places where the roads had been swept it was necessary to sweep the ground very frequently to avoid white patches without tar; but where water under pressure had been employed, the tar was incorporated with very little trouble. Two days after tarring, traffic was resumed in the streets. A layer of sand was laid on the tar; but it was regarded as unnecessary in cases where traffic can be stopped until the tar is hard. Rain which fell for some days, almost immediately after tarring, had no apparent prejudicial effect. The streets have been open to traffic for nearly six months, very heavy rain having fallen half the time, and are in fairly good condition, though the tar has been torn away in places, and hollows have formed here and there.

An inspection of the work showed: (1) That no difference is observable in the hard tar between places freed from dust with brooms or water under pressure. (2) During rain the tar got rather soft; but with a return of dry weather it hardened again, having the same appearance as before. Moreover, the tarred streets dried in one-third of the time taken by others. (3) During the period which has elapsed since tarring, no dust or mud has been found on the streets which was not observed in other streets. (4) When a tarred street shows pools or hollow places, it should be picked up and rolled. Traffic should be stopped until all is solid, after which tar can be applied.

Midland Junior Gas Engineering Association.—We learn from the Hon. Secretary (Mr. James Hewett) that, on the invitation of Mr. Hubert Pooley, the President of the Midland Association of Gas Managers, a visit has been arranged for next Saturday to the gas-works of the Corporation of Stafford.

Removal of Sulphuretted Hydrogen from Gases.—According to a German patent that is briefly noticed in the current number of the "Journal of the Society of Chemical Industry," the gas is treated with a solution (of acid reaction) of neutral or basic ferric salts of organic hydroxycarboxylic acids, especially lactic acid. The spent reagent may be regenerated by warming and treating with oxygen or air under pressure. The reagent oxidizes the sulphuretted hydrogen with formation of sulphur.

The South Metropolitan Gas Company and School Children's Meals.—Many of our readers may have noticed in the papers an appeal by the Chairman of the London County Council (Mr. H. P. Harris), which was strongly supported, for funds to provide meals for school children; the County Council having decided not to levy a rate of ½d. in the pound under the Education (Provision of Meals) Act, as they were empowered to do. The first list of subscriptions, which was published in "The Times" last Tuesday, included a donation of £228 7s. 9d. from the South Metropolitan Gas Company. This donation was explained in a letter, by Sir George Livesey, to the Chairman of the Council as follows: "Sir,—In response to your appeal, backed by the letter of Lords Rosebery, Rothschild, and Avebury, and Mr. Balfour, I enclose a cheque for £228 7s. 9d., as a contribution from this Company to the 'Provision of Meals for Children Fund.' The amount of the cheque is equal to a half-year's rate of ½d. in the pound on the Company's assessment. It was unanimously voted by the Board to-day [Dec. 24] on the ground that if this need is not met voluntarily there is the certainty that it will be made a charge on the rates, and, if so, there is the equal certainty that it will not stop at a ½d. in the pound. Seeing that this Company's business is confined to the south of the Thames, it is the desire of the Directors that the contribution should be devoted to South London."

PREVENTION OF ACCIDENTS IN GAS-WORKS.

Suggestions from America.

In the "JOURNAL" for the 24th ult. (p. 897), it was mentioned that a Committee of the Michigan Gas Association had submitted a report upon accidents occurring in connection with the gas industry; and an epitome was given of the questions sent out by the Committee and the replies received. We supplement those particulars by a few extracts from the report.

In order to approach their subject in a logical and systematic manner, and to provide a framework upon which to build, the Committee made the following classification of accidents: (1) Those peculiar to the gas industry. (2) Those not peculiar to, but common in, the gas industry. (3) Fires and fire protection. They divided the first group into accidents incidental to (*a*) manufacture, (*b*) distribution, and (*c*) bye-products. The accidents incidental to manufacture embraced those occurring in the production of coal, water, and Pintsch gas, and in the various processes connected with its purification, storage, and distribution. The second group was divided into accidents arising in connection with the working of engines, boilers, heating systems, elevators, &c., as well as those due to faulty construction. The third group did not require division.

Dealing first with accidents incidental to gas manufacture, the Committee make some remarks on "Retort-House Problems."

Ventilation.— Probably four-fifths of the retort-houses in America are poorly ventilated. Carbon dioxide, poisonous smoke in the eyes and lungs, excessive temperature, all resulting from poorly ventilated retort-houses, have made the stoker problem well-nigh impossible. The following precautions and suggestions will be found of value: Build the roof high and with a steep pitch. Make the ventilator openings more than large enough, and see that there is an opening in the roof directly over the line of the mouthpieces. Gases usually go straight to the roof; and if their exit is impeded in the slightest degree, they will circle back down the side walls. In the end walls openings should be provided which can be opened wide in summer and closed during the winter months. Many old retort-houses can be made bearable during the summer by removing sections of the roof, cutting holes in the end walls, or taking them out entirely, if made of boards. The cost of making openings in the spring and closing them up again in the autumn is nominal; and the increased comfort of the stokers, with a decided improvement in results as a consequence, will pay for the changes many times over. In certain sections of America, where the winters are not very severe, it would seem that the retort-house building might be dispensed with in part, or even entirely. Sufficient cover and protection could be erected or provided for the workmen, and the stack itself placed in the open. Side walls and roofs to a great extent could be dispensed with. This type of construction has its advocates among gas men, even in the regions of northern climate—its supporters pointing to present coke-oven practice as an example. Here the ovens are open to the weather, and the workmen are housed on the machines they operate. This matter will bear investigation, and should be carefully considered by every gas man before he puts good money into what is perhaps needless building. Cellars may be ventilated by the use of fans, which draw the steam and gases arising from the quenching through closed fires and discharge them into the outside air. A number of small fans, placed close under the floor and discharging outside, will be found of considerable help; and also ventilating shafts opening into cellars just under the charging-floor and extending up to the roof line. A number of these built into the wall at regular intervals will carry off the steam and gases very rapidly. Several works have installed a blower system, with piping so arranged that fresh cool air is blown upon the backs of the men while working in the heat of the retorts. This arrangement has been installed in the Rochester (N.Y.) works, and has proved very beneficial. One 6-inch opening is provided in front of each bench.

Retort-House Charging-Floor.—The common retort-house floor, consisting of steel frames and cast-iron floor-plates, is dangerous. Steam and hot gases from the cellar below quickly destroy paint protection, and the beams rust out very rapidly. A new 6-inch I-beam, carefully painted with red lead, has been found so eaten and corroded, in two years from the day it was installed in a retort-house, that it was necessary to replace it with a new one. Cast-iron floor plates are liable to breakage, become loosened, and slip from their bearings. The best type of retort-house floor is one in which the beams are completely encased by concrete; and the floor itself may be either reinforced concrete or brick tile, or a combination of these. The modern practice seems to be a reinforced concrete floor, with plates adjoining the benches, and brick laid along the rails where charging and discharging machines are used. A combination concrete and brick floor, having brick for the top surface, would seem to offer many advantages. The framework of the charging floor must be erected absolutely independent of the benches and the stack ironwork. Failure to observe this precaution has resulted in extensive and costly repairs and some personal injuries.

Half-Depth Bench with Pit Construction.—For small plants, a rear-clinkering half-depth bench, so situated that the ashes, &c., may be wheeled out from the pit bed to the ground, is in many respects ideal. This demands a side hill or extension excavation. Where this construction is not possible, it is a question whether the additional economy of a half-depth over a direct-fired bench is worth the price. The common half-depth bench, with its dark, hot, foul, back-breaking pit—too low to stand up in and too high to climb out of—is an instrument of torture. Do not build them. Wait and build verticals.

Some Retort-House Accidents and Suggested Remedies.—(1) Men burnt while darkening fires, due to hot coke falling in the water in each pan. Remedy: Clinker fires without removing the grate-bars. (2) Man had foot run over by wheel of drawing-machine. Remedy: Provide machine wheels with guards. (3) Man injured by a piece of hot carbon flying into his eye from scurfing a retort. Remedy: Place a light metal shield in front of the retort being scurfed; also in this connection, to prevent the mouthpiece getting red hot, allow a small steam-jet to play upon the inside of the mouthpiece. (4) Men injured by being caught between the drawing machine and a post supporting a coal bin, owing to the faulty design of house. Remedy (the only possible one): Change in construction. (5) Men strangled, burnt, and made sick by hot gases arising from cleaning out stand-pipes during the scurfing of retorts. Remedy: Open the stand-pipe before starting scurfing; also provide men with "smoke-muzzles"—an apparatus like a football player's nose-guard containing a moistened sponge. It is a very good device to use in any smoky and dusty atmosphere. The above are a few of the retort-house accidents reported.

Accidents Peculiar to Water-Gas Manufacturing.—Where possible, the generating-house should be isolated—that is, exposed on all four sides. If the air from the blower system is cool, openings from the blast-pipe may be let into the room. These will provide fresh air in the hot weather, and they are also sure to indicate leaky or open valves. Windows should be removed during the summer months, and roofs built high and with large ventilator openings. Condensers and scrubbers should be placed out of doors. In southern climates, much of the generator-house building may be dispensed with. The steel beam floor with iron floor-plates has apparently given general satisfaction. Round walks should be provided for the use of the operators where the heat is excessive. Floor should be carefully inspected at regular intervals. The best ground-floor is brick.

Blast-Pipe Explosions.—The cause of these is almost always carelessness on the part of the operator, but occasionally it is the result of leaky or broken valves. The only way to prevent these explosions is to eliminate the human element. This is best accomplished by the use of a butterfly or hydraulic valve in the blast, which opens and closes with the stack valve, while at the same time a vent-pipe is opened to the air. Hydraulic valves get out of order; the rod and lever mechanism is more positive. Vent-pipes, placed just outside the blast-gates, and opening on the operating floor at some convenient point under the eye and nose of the operator, have prevented many accidents. Relief-valves, hat-plugs, paper flanges, &c., are commonly used. In some cases they seem to have proved effective, while in others they have been of no help. Blast-pipes laid in brick or concrete trenches offer the inducement that, in the event of an explosion, the whole may be covered over and used as a blast conduit until a new pipe can be obtained. A reserve set of piping and an extra blower should be kept on hand at all times. There is a growing tendency towards providing each set with its own blower, which is either motor or turbine driven. Direct-connected outfits of this type running at high speed take up very little floor space, and may be placed on the operating floor.

Wash-Box Explosions.—Accidents of this class happen during the cleaning of the wash-box, and are almost invariably due to a violation of rules or ignorance on the part of the workmen. The wash-box must be filled to overflowing with water before removing any of the cleaning-plates on either the stand-pipe or the wash-box itself. The valve between the box and the scrubber must be closed, and kept closed, during the operation. After cleaning and closing up the box, before starting up it should be again filled with water, and gas from the system allowed to back up into it as the water runs off.

Oil Fires.—A gasket on an oil-meter blew out, the oil ignited, and the operator was burnt. Shields placed about the meter will prevent oil from squirting about the room. All oil-piping should be extra heavy. Oil-pumps should never be placed in the regenerator-room, but should be isolated, if possible, and located in a fireproof room. All oil-piping should, as far as possible, be run where a leak or break can do no damage.

Relief Holder Blowing and Depression in Crown.—Light the holder so that its position can be readily seen. . . . Electric alarms, elevator indicators, &c., are all open to the objection that they may get out of order; and, being relied upon, an accident is almost sure to follow. A travelling indicator in the generator-room is, however, in some cases indispensable.

Gas Explosion in Machine.—One case reported was due to the following causes: The machine was being fired up, and was under natural draught with the coaling-lid closed and the ashpit doors partly open. The men were working on the down-run valve, and had both top and bottom valves partly open. Air flowed into the carburettor through the down-run valve, and formed an explosive mixture with the generator gases. A series of explosions, at intervals of a few seconds, followed until the lower valve was closed.

Accidents Peculiar to Pintsch Gas Manufacturing.—These are mostly caused by the firing of gas oil or hydrocarbon. The latter

should be stored underground, in well-protected metal tanks, and the utmost care used in handling it at all times. A number of fires in Pintsch plants due to a poor oil-supply system have been reported. The one in use by the Detroit Gas Company, where the oil-supply tank is underground, outside the retort-house, and the oil is forced out by displacement, is, in the opinion of the Committee, to be recommended.

The Committee next proceed to deal with the classes of accidents which, while common to all processes of gas manufacture, are still peculiar to the industry. To these we purpose referring in a subsequent issue.

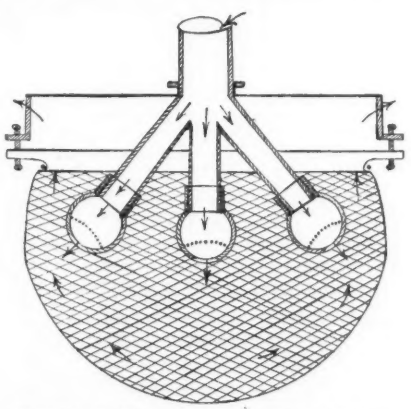
REGISTER OF PATENTS.

Incandescent Gas-Burners.

FISCHER, H., of Berlin.

No. 19,753; Sept. 5, 1906.

This invention relates to inverted incandescent gas-burners of the multiple-nozzle type—that is, of the kind comprising a plurality of burner nozzles connecting with a common mixing tube or chamber receiving gas and air from the usual sources. Incandescent mantles are combined with these burners in various ways. In one arrangement, each nozzle is furnished with an independent body; in another the body is constructed in independent sections with each of which a certain number of the burner-nozzles are combined; and in yet another a burner-head of the "mitrailleuse" type is used with one body.



Fischer's Multiple-Nozzle Incandescent Burner.

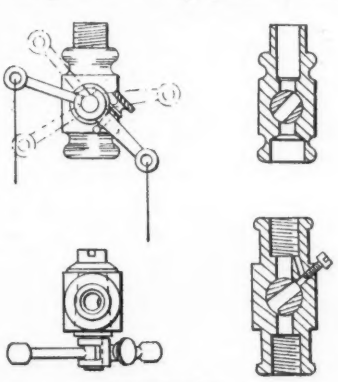
The present invention provides a multiple-nozzle burner for use with a single large hemispherical incandescent mantle, and "so arranged as to heat it equally." As shown, each nozzle consists of a pipe branching from a common mixing-tube, and furnished with a detachable mouthpiece provided with an opening and a series of perforations for the exit of the gaseous mixture. The mantle into which the mouthpieces are directed is of hemispherical shape, and, the patentee remarks, is, "therefore, as will be obvious, equally rendered incandescent in use whereby effective illumination is obtained and the life of the mantle prolonged."

Gas Valves or Cocks.

NOTT, G., of Mayals, near Swansea.

No. 27,429; Dec. 1, 1906.

This invention relates to plug cocks of the type wherein the light of any burner to which the valve is applied may be lowered to any predetermined extent, although not completely turned out, when desired, without having to adjust the burner on each occasion, but in no way interfering with the operation of the plug handle, should it be desired



Nott's Gas Plug.

to turn the gas completely off. It consists (as shown) in providing, in addition to a main operating handle or lever arranged to open or close the valve in the ordinary way, an auxiliary handle or lever in operative connection with the valve plug, and having a variable limited movement such that the valve cannot be completely closed thereby.

The illustration shows: An elevation of the valve or cock; a plan; and a vertical section through the valve. A slightly modified form of construction is also shown.

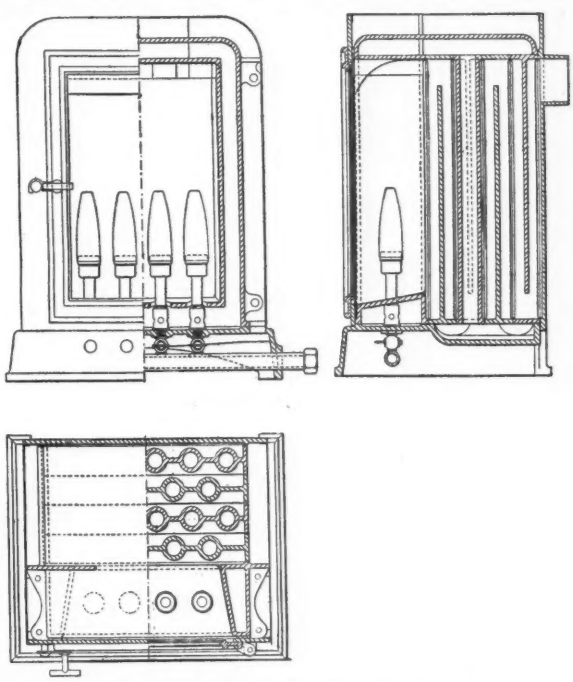
Regenerative Gas Heating-Stove.

MARTIN, A. J., and RIDEAL, S., of Victoria Street, Westminster.

No. 27,621; Dec. 4, 1906.

This invention has for its objects (according to the patentees) "the maintenance of the combustion chamber at a high temperature with a minimum consumption of fuel, the emission of a maximum amount of radiant heat, and the prevention of the smell which is caused by the exposure of heated surfaces to the air and the charring of the dust particles thereon."

In order to prevent such charring, the inventors propose to keep the exterior surfaces of the heater comparatively cool, and restore to the combustion chamber as much as possible of the heat which would otherwise escape from these surfaces; they also transfer from the products of combustion to the air supply the greater part of the heat which they contain. In gas-stoves as hitherto constructed, the object in view, they point out, has been to heat the air of the room by contact with the hot surfaces of the stove; and to carry out this object more completely, passages have often been formed through the body of the stove for the purpose of presenting a large area of heated surface to currents of air which are drawn through the stove and eventually find their way into the room. In some cases also, with a view to the utilization of the heat of the products of combustion, these are discharged into the room, with or without the admixture of additional air.



Martin and Rideal's Regenerative Gas-Stove.

According to the present invention, not only do they not aim at heating the air of the room directly, but they expressly avoid doing so, and carry back to the combustion chamber the heat which would otherwise be imparted to the air, in order to convert it into radiant heat.

Apparatus made in accordance with the invention comprises (as shown) a combustion chamber, a burner or burners, a mantle or other radiating material, a wall or walls of material through which radiant heat will freely pass, and a regenerator for heating the air supplied to the burner or burners—the regenerator being disposed in an air jacket or other non-conducting envelope.

In carrying out the invention, the combustion chamber is enclosed and the air for combustion is admitted in proper quantity through a tube or chamber, or series of tubes or chambers, between or around which the products of combustion are caused to circulate, so as to impart their heat to the incoming air. One or more of the walls enclosing the combustion chamber are made of glass or other diathermal material through which the radiant heat from the radiating material may penetrate. The radiant heat is obtained from any suitable material which is capable of being raised to a high temperature—such, for instance, as the incandescent particles in an ordinary gas or oil flame, an incandescent mantle, or a net or veil of asbestos or other suitable material, with or without an admixture of refractory oxides of high radiating power. Pieces of fireclay may also be used.

The regenerator and combustion chamber (except as regards the walls provided for the emission of radiant heat) are enclosed in a shell of any suitable material, so that all heated surfaces may as far as possible be cut off from the outer air; and in order to maintain this shell at a low temperature, and restore to the combustion chamber the heat which would otherwise escape, the air for combustion is preferably drawn in through the space between the shell and the combustion chamber and regenerator. Suitable provision is made for collecting the liquid condensed from the products of combustion.

After a detailed description of the arrangement illustrated, the patentees conclude: "We are aware that the regenerative principle

has been employed in many existing stoves, in which the incoming air is heated to a greater or less extent for the purpose of securing a more perfect combustion than would be possible with cool air. While carrying the regenerative principle much further than in any prior heater, we claim no originality in the use of this principle, except in combination with the other distinctive features of our invention. We are also aware that it has been proposed to enclose the central part of a gas-stove in an outer shell, and to pass air through the space between the central part and the shell; but where this has been done in apparatus which in other respects resembles our own, it has been done for the purpose of heating the air supply of the room, and the air so heated has been discharged into the room, either directly or after being further heated in the combustion chamber. According to our invention, we enclose the combustion chamber to limit the air supply to that required for perfect combustion, and keep the intensely heated surfaces out of contact with the air of the room. We also dispose the passages to and from the combustion chamber alternately, for the purposes of heating the air required for combustion, and checking the conveyance of heat away from the stove by the products of combustion."

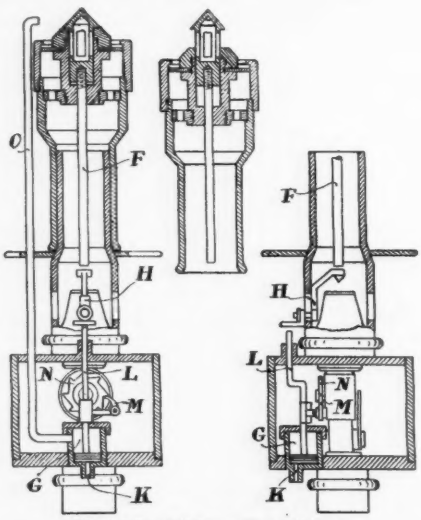
Lighting Gas at a Distance.

BIRNBACH, H., of Vienna.

No. 28,094; Dec. 10, 1906.

This gas-lighter is of the type in which the device for turning the cock at the same time operates the rod carrying the ignition medium, so as to move the ignition medium from a projected position to the operative position, the ignition medium being placed centrally in the burner.

The illustration shows (1) a longitudinal section through the bottom portion of the burner; (2) the whole burner in a longitudinal section in the plane normal to the first; (3) the upper portion of the burner with the parts in a different position.



Birnbach's Distance Gas-Lighter.

The casing containing the "ignition pill" is adjustable in a cylindrical portion of the burner-head. It is provided with lateral recesses, and closed at top by a cap resting with its edge on a conical projection of the burner-head, so as to close the space containing the ignition pill. The raising of the casing required for the purpose of lighting, is effected by a rod F, which can be pushed by a slide H, operated by the rod L of the compressed air cylinder G. The compressed air cylinder is operated by a cylinder, the spring-controlled piston of which can be forced by hand into the cylinder, in order to compress the air contained in it. The air thus compressed passes through the connecting pipe K under the piston of the cylinder G, and, by means of the rod L, raises the casing, and by the pawl M, secured to the rod L, turns the gas-cock provided with a ratchet-wheel N.

The current of gas escaping through the burner-head comes into contact with the ignition pill; and as the point of ignition is situated in the gas current itself, the lighting takes place. As soon as the pressure of air in the cylinder G ceases, the casing sinks and returns to its original position, whereby the ignition pill is brought out of reach of the flame.

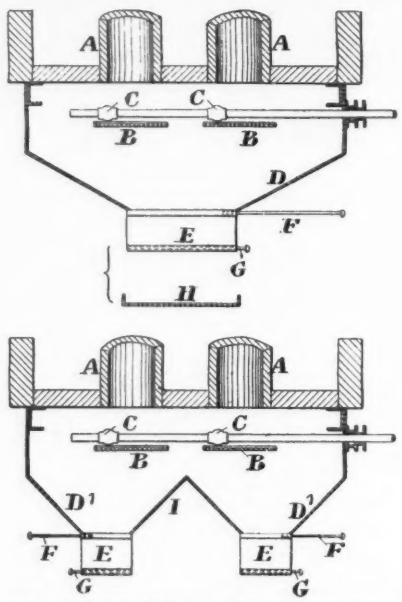
In order to obtain at the point of ignition a mixture favourable for ignition, an air-pipe O is provided, starting from the air-cylinder and passing outside the burner up to the level of the ignition point—the pipe supplying air when the ignition apparatus is operated. The pipe is of such dimensions as to admit to the place of ignition exactly the required quantity of air. It can, however, be provided with a passage which could be adjusted to the quantity of air needed for producing the proper mixture.

Vertical Gas-Retorts.

WOODALL, H. W., of Wimborne, and DUCKHAM, A. M'D., of Upper Parkstone, Dorset.

No. 28,580; Dec. 14, 1906.

In operating vertical retorts for the destructive distillation of coal, the patentees point out, some device must be used for continuously removing the coke from the bottom of the retort. Such apparatus has usually been enclosed in a gas-tight hopper, the lower part of which is provided with a device whereby the coke can be removed without the escape of any gas or the admission of any air. This arrangement, however, "does not sufficiently prevent the escape of gas, inasmuch as the coke is saturated therewith, and the device always removes some gas from the hopper together with the coke." By the present invention, the escape of even this small quantity of gas when the coke is discharged is said to be prevented by quenching by water or steam, either in the bottom of the hopper or the removing device, the coke deposited from the retorts before it is discharged—the steam expelling the gas into the hopper, so that practically none is carried out with the coke.



Woodall and Duckham's Device for Removing Coke from Vertical Retorts.

Hoppers of the kind in question, applied respectively to a single retort and to two retorts, are shown in the engraving.

Beneath each of the retorts A is supported a plate B, along the surface of which moves to and fro a pusher C carried by a rod. These parts are described in patent No. 21,447 of 1905, and are contained in a closed hopper D, into which open the lower ends of the retorts. The bottom of the hopper is closed by two doors F G, having a space between them. These doors are capable of being opened or shut independently, and may be actuated either by hand, gearing, or independent power. The coke as it is discharged from the retorts passes into the space E (the door F being open), and falls on to the door G, where it remains for any desired length of time, but preferably until the space E is conveniently full. The door F is then closed, and thereupon G is opened, and is shut again as soon as the coke has been discharged into the conveyor H. Then the door F is re-opened, and the fresh coke from the retorts is allowed to enter the space E.

The coke is preferably quenched while in this space, either by the admission of steam or water; "so that any gas that may be present in the space is expelled into the hopper, and none, or practically none, escapes with the coke."

In the second arrangement, there is a hopper D^1 for each retort; these being combined with a closed casing I.

For the purpose of illustration, the patentees show in this specification the discharging device described in their specification No. 21,447 of 1905; but they say that any other means suitable for the continuous extraction of coke from the retort—such as a pair of screws or a rocking motion—may be used. So, also, instead of the double doors to the hopper, a rotary gas-tight device may be adopted with one or more pockets in it, and actuated periodically or continuously as desired, or "any device may be used which prevents direct communication between the retort and the air when the coke is being discharged."

Gas-Producers for Use with Fuel containing Volatile Matters.

DANIELS, J. S., HIGGINS, E. P., and DANIELS, F. L., of Stroud, Glos

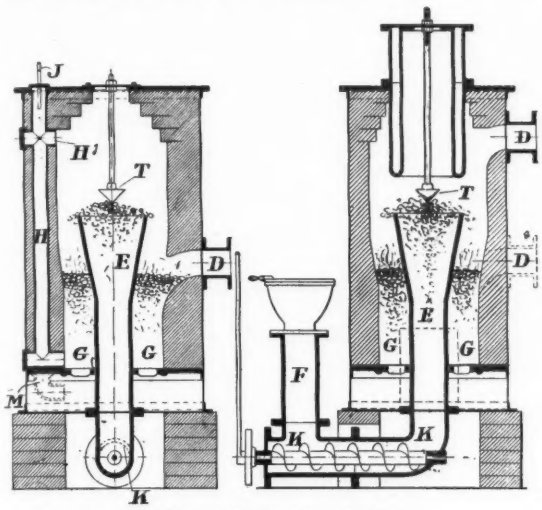
No. 1313; Jan. 18, 1907.

This invention has for its object "to provide efficient means for collecting and utilizing the distilled and condensible gases from the fuel."

The first illustration is a side elevation of the plant with the producer so arranged that the volatile gases are carried through the fire. In the second form, the volatile gases are taken direct to the cleaning plant.

Within the casing shown there is built up a fire-brick or other like material lining. In any convenient position is a feed-hopper, with a valve or other covering and protecting device; the feeding-hopper tube or branch F (in the second arrangement) communicating with a receiving chamber or receptacle K below the fire-bars G of the producer. Connected to the chamber K is a retort E of metal or other suitable material. The retort is caused to pass through the fire—the end being open and having a spreading device T arranged some distance above the opening, so that the fuel will pass out freely and feed the annular fire round the retort, and from which the distilled gases and vapours may be drawn or allowed to escape by means of an opening or openings H^1 leading thereto. The fuel is fed through the retort by means of a screw or other suitable mechanism arranged at the lower end.

The distilled gases and other products escaping from the upper end of the retort are collected by means of the opening H^1, which leads into a conduit passage or pipe H that may be carried down within the material forming the lining of the producer, or by means of an independent exhaust pipe or pipes. Alternatively, the distillation products may be carried away through a cleaning plant with the ordinary producer gas from the annular fire around the retort.



Daniels and Higgins' Gas-Producer.

The lower end of the collecting pipe H is joined to a feeder branch, which delivers the distillates and gases to the lower portion of the fire-grate within the zone of combustion or below the fire-grate with a feeder M of any suitable form.

Steam is introduced through a nozzle J, or an exhaust fan or other suitable apparatus is arranged for the creation of an induced draught in the conduit H—placing such nozzle, exhaust fan, or other apparatus in any convenient position to suit the form of conduit and connections that may be used. The primary air supply is delivered in the space immediately below the annular grate.

In the modified form of the invention, the producer has an outlet D above, or near the level of, the top of the fuel in the fire, to cause the distilled gases and other products to be carried direct from the mouth of the retort E to the outlet D, together with the producer gases from the annular fire, and thence through a suitable cleaning plant.

Extracting Cyanogen from Gas.

LESSING, R., of Connaught Street, W.

No. 2090; Jan. 28, 1907.

The wet extraction of cyanogen from coal gas or like gases in the form of iron cyanogen compounds has, the patentee states in his specification, hitherto been effected by various processes, of which the washing or scrubbing of the gas with ferrous salts were the main features. The iron was applied either in the form of aqueous solutions of soluble iron salts – such as the sulphate or chloride, or else in the form of suspensions of iron oxides or insoluble iron salts, such as sulphides or carbonates in solutions of hydrates or carbonates of the alkalies or in milk of lime. It was also proposed by Dr. Knublauch (in his English patent No. 15,164 of 1887) to replace (in suspensions of iron oxides, carbonates, or sulphides) the alkali required by ammonia; the iron compound being either brought into the liquid or formed therein by chemical decomposition or synthesis. However, in the process referred to no objection was made to the presence of acid radicles which form "fixed" ammonium salts—that is to say, compounds from which the ammonia cannot be expelled by boiling without the addition of alkalies or alkaline earths. The formation of these "fixed" ammonium salts causes the neutralization of part of the free ammonia present; and the present patentee says he has discovered that, by thus reducing the alkalinity of the gases or the reacting mixture, the ready extraction of cyanogen is impaired, and that the presence of the "fixed" ammonium salts is prejudicial to a convenient working up of the resulting products.

His invention therefore relates to an improved method of carrying out the prior process referred to, of extracting cyanogen from gases, by which the presence and formation of neutral ammonium salts is avoided; and it consists in washing or scrubbing the gas previous to the extraction of ammonia with suspensions of ferrous oxide, hydroxide, or such iron salts of the protoxide type the acid radicles of which do not form "fixed" ammonium salts on entering into combination with ammonia. These iron compounds—such as ferrous hydrate, carbonate, and sulphide—are suspended in water, or in ammoniacal liquor free from fixed salts; and they may be used each by itself or in mixture with one or more of the others.

Dr. Lessing has found that such a washing or scrubbing agent avoids the "fixation" to other than to ferrocyanide radicles of ammonia and its transformation into indifferent ammonium salts, which unnecessarily load the reacting mixture and render the subsequent working-up of the products more complicated. Further, using the ammonia present in the gas and dissolved in the suspension liquor as a base for the formation of iron cyanogen compounds, the present process avoids the employment of any alkali in the extraction.

The invention may be carried into effect in various ways, of which the following may serve as examples:

The washing or scrubbing liquid is prepared by precipitating from a solution of a ferrous salt—such as ferrous sulphate or chloride—the iron by means of ammonia or ammonium salts other than "fixed" salts or the corresponding compounds of the alkalies. For example, a ferrous sulphate solution may be treated with the vapours from an ammonia still or with a condensate thereof, or with crude coal gas containing ammonia from which cyanogen has been previously removed, or it may be precipitated with alkali carbonate or sulphide or caustic alkali, or ferrous salts, the radicles of which form soluble salts with the alkaline earths, may be treated with milk of lime or the like. For instance, the iron cyanogen sludge obtained by a previous working, as hereafter described, may be treated with milk of lime, yielding calcium ferrocyanide, and leaving a suitable ferrous material as residue.

In any case, the salt solution is separated from the ferrous hydrate, carbonate, or sulphide by decanting or filtering, and the precipitate is washed, if possible in a filter press or a centrifugal extractor, or on a vacuum or other suitable filter. During these and the subsequent operations, the access of air or oxidation of the material generally should be avoided. The ferrous precipitate prepared by any of these methods (or a mixture of such precipitates), which will be in a more or less pasty form, is then suspended in water or ammoniacal liquor containing practically no "fixed" ammonium salts, or in the distillate from ammonia stills, whereby care should be taken to divide the precipitate finely and distribute it evenly throughout the fluid by stirring or agitating the mixture. The strength of the suspension will have to vary according to local conditions and the products desired. A mixture containing about 0·5 to 0·6 lb. of iron per gallon of liquid has been found to give satisfactory results.

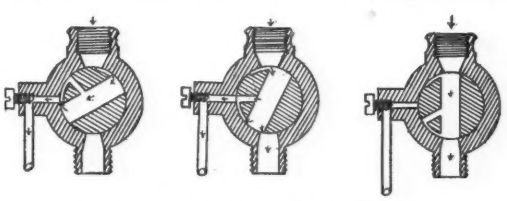
With this suspension the gas is washed or scrubbed after the extraction of the tar or tarry matters, which should be as complete as possible and previous to the extraction of its contents of ammonia. Any efficient gas washing plant may be used. With the aid of the ammonia present, practically all the cyanogen contained in the gas is absorbed by the ferrous compounds—forming a more or less fluid sludge of black or bluish grey appearance, which is very suitable for the manufacture of ferrocyanides according to known methods.

Bye-Pass Gas-Cocks.

HINTON, E., of New Bond Street, W., and ANDREWS, F. A., of Winchmore Hill, N.

No. 4535; Feb. 25, 1907.

The object of this invention is to so construct bye-pass gas-cocks that the pilot flame may be varied in size or extinguished as required.



Hinton and Andrews' Bye-Pass Gas-Cocks.

The gas-cock shown is so constructed that the pilot flame is small when the main burner flame is not alight, increasing in size at the moment of ignition, and extinguished immediately after the main flame is alight. The reverse action takes place as the burner flame is being extinguished.

The first view shows the cock with the plug turned so that the passage to the main flame is closed by the body of the cock, while a small groove forms a passage for the gas to the pilot tube. The second view shows the cock with the plug turned so that gas passes to the burner, and is ignited from the pilot flame. At the same time an additional quantity of gas passes through the then horizontal channel to the pilot flame, thereby increasing the size of the flame at the moment of ignition. The third view is of the cock with the plug turned so that the passage to the main flame is fully opened. When in this position, the passage to the pilot flame is closed by the blank portion of the plug.

Cooling, Washing, or Enriching Gases.

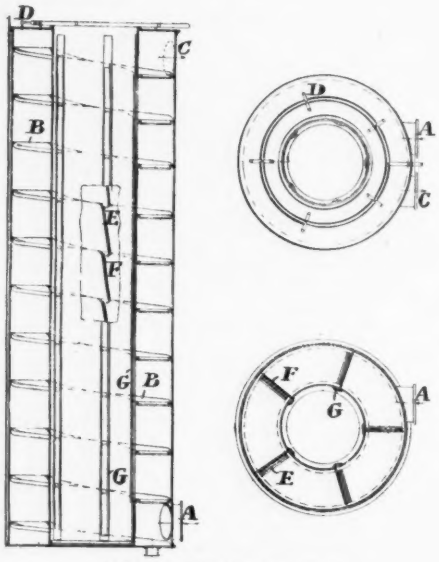
MARKS, E. C. R.; a communication from Actien Gesellschaft fur Kohlendestillation in Gelsenkirchen-Bulmke.

No. 6023; March 12, 1907.

This invention refers to a device for cooling and washing gases (or for enriching gas or the washing medium) of the type in which the cooling or washing medium flows over a spiral surface, while the gases pass through the device in the opposite direction. The invention consists in arranging perforated insertions beneath slots or rows of holes which are provided in the coil-surface, preferably corresponding to the number of inlets of the washing medium. This causes the cooling or washing medium flowing uniformly and continuously over the coil-surfaces to be uniformly distributed by the slots, and to be passed over the perforated insertions to the spiral passage situated below. This "continuously cleanses the spiral surface from precipitates and perfectly purifies and cools the gas."

The gases enter through a branch A (p. 44), rise along the helicoidal surface B, and leave at C. The washing liquid, introduced at the top at (say) five places D, is uniformly distributed over the whole width of the surface B, and follows its course in a downward direction. Before, however, the liquid of one inlet meets the liquid of the one in front, it drops through a slot or a series of holes in the helicoidal surface on to the thread below "in the shape of a thin layer or veil," whereupon it continues its course. Then after one-fifth of a circular movement, it drops again through a slot or series of holes on to the next thread; and so forth. In this manner, the liquids of two "cascades" will not become mixed; so that "a uniform enriching of the washing medium, and consequently a complete utilization of it, and a good efficiency of

the whole apparatus are ensured." In case of five inlets, five cascades will also be formed on each thread of the helicoidal surface through which the gases must pass.



A German Washer-Condenser.

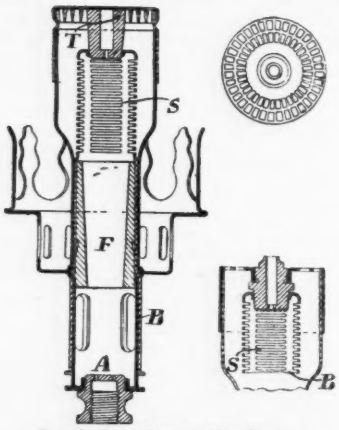
In case the washing liquid when flowing over is apt to form single jets by contraction, it is preferable to arrange (underneath the overflow) frames F, filled in with perforated iron plates, wire-gauze, wooden screens, or the like, over which the liquid, distributed in a uniform layer, can move in a downward direction; so that the whole of the available section is utilized. The sieve frames F, for cleaning purposes or for exchanging or completely removing them, are made accessible by means of lids G.

Incandescent Gas-Burners.

BRAY, J. W., of Leeds.

No. 8323; April 10, 1907.

In this burner, the nipple is provided with an upstanding annular casing A, provided with air apertures. On or in the casing is placed a bunsen tube B, provided towards its base with air apertures to correspond with the others; the regulation of the air supply being accomplished by turning the bunsen tube one way or another by means of the flange shown. The bunsen tube is made of comparatively large diameter, and the top closed by a cover or (preferably) by the under portion of the tip T. Alternatively it is provided with perforations fine enough to prevent the mixture of gas and air from lighting-back. When the opening is closed by the portion of the tip, the tube B may



Bray's Incandescent Gas-Burner.

be readily cleansed. In the circumference of the bunsen tube towards the top and for some distance down are formed horizontal slits, perforations, or the like S, of comparatively small width. If these slits or perforations are too large, lighting-back will take place, unless provision is made in the burner head or tip to prevent it. The burner tip may take several forms as regards the apertures—straight walls even may be employed. The outlet from the air-chamber into the bunsen tube is provided with an injector F of some refractory material having a smooth surface, to which particles of dust or the like will not readily adhere. The diminishing takes place from the entrance of the bunsen tube towards the slits—that is to say, the aperture is comparatively small where the gas and air mixture enters the bunsen tube, but enlarges to practically the same diameter as the bunsen tube.

The Tipton Urban District Council have decided to borrow, subject to the sanction of the Local Government Board, a sum of £5000, to be expended on new gas meters, mains, and services.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The "Honec" Patent Gas-Heater.

SIR,—Your article on the "Honec" patent gas-heater, in the last number of the "JOURNAL," is very interesting; and as I have used this form of heater, with an upright bunsen, for some years, to prevent the water-cistern at my house from being frozen, I can endorse what you say as to its efficiency. It will give out an agreeable heat when turned down so as to consume even less than 5 cubic feet of gas per hour.

York, Jan. 3, 1908. J. H. HILL.

Oil Consumption in Gas-Engines.

SIR,—I notice in the report of my lecture on "The Reliability of Gas-Engines," in the "JOURNAL" for the 24th ult., that the reference to oil consumption is not sufficiently stated, and is somewhat misleading as to what can be accomplished in gas-engine oil economy. Messrs. Cadbury, Limited, kindly sent me full particulars of the running of their Westinghouse plant driving electrical generators of 300 kilowatts capacity in two units, and gave me the figures quoted for oil consumption during 1905. These run out to 1·7d. per B.H.P., or 0·085 gallon per B.H.P. per week of 72 hours. As they show a gradual improvement year by year, no doubt the present consumption is considerably less than this.

But I should not like your readers to think that this cannot be improved upon in present-day gas-engine practice; and therefore I give the following quotation from the lecture, based upon the engineer's report on the working of a Crossley plant of 180 B.H.P. at the works of the New Arrol-Johnston Car Company, Paisley: "The total oil used per week for all purposes was 3·6 gallons, at an average cost of 1s. 8d. per gallon. This runs out to 0·012 gallon per B.H.P. per week of 60 hours, or 0·24d., or ¼d., per B.H.P. per week of 60 hours."

Jan. 2, 1908. A. VENNELL COSTER.

Raising Low-Level Water for High-Level Service.

SIR,—In reply to the letter on this subject in the last number of the "JOURNAL," I beg to refer Mr. Johnston to the information requested by "Interested" in the issue for Oct. 29 last (p. 354), who asked readers of the "JOURNAL" to "give a description of the engine and works, and state where they may be seen." The reviewer of Mr. M'Pherson's "Water-Works Distribution" (see "JOURNAL" for Oct. 8 last) said: "The author has omitted the scheme of utilizing the whole of the low-service supply by passing it though a hydraulic engine, thus pumping a sufficient quantity of water to supply the higher districts." I see no reason why such power at hand in numerous places cannot be utilized. I therefore described the first installation of which I had a knowledge some thirty years ago. Possibly I may not be "up-to-date" as to the work which has been carried out at Brighton in recent years; but this does not detract from the value of the hydraulic engine and its use for the purpose indicated by "Interested."

It is not stated that such a system of lifting a part of the high-service water by the power in use—viz., the low-service supply—could not be superseded as the population increased and new engines and works would be required. What "Interested" asks for are instances where the system has been installed and peformed efficient service. Even your "anonymous correspondent" can judge as to the advisability of carrying out a work of this nature and saving the cost of fuel, &c. Will Mr. Johnston kindly enumerate some of the water-works where such a system is adopted, and so help a member seeking information through the proper channel—viz., the "JOURNAL"?

Jan. 3, 1908. M. A. W. E.

Association of Water Engineers.

SIR,—This Association has a number of associate members—young men advanced in their profession, having had extensive practice as assistant water engineers, distributing engineers, and foremen of pumping and filtration works. A thorough knowledge of the latter is the most important and valuable of all the departments. Filtration is no longer carried on in the rude slip-shod fashion of ten to twenty years ago, but the work is now regulated with the utmost accuracy and precision. Every portion of the work is recorded diagrammatically; the Venturi meter diagrams being in full view of the foreman of filter-beds, who is responsible for absolute and perfect filtration. The engineer inspecting the meters records the rates of flow on top of the sand, and also the flow under the sand at the same time; and continuously day and night he knows that there is perfect safety, and that the analysis will be always the same. I have known men to be appointed to responsible positions in water-works who have had no preparation or training in any branch of water-works engineering.

I wish to direct attention to our associate members. If the members of the Association of Water Engineers would help the associate members, the Association would progress more rapidly and justify its existence. Surely to appoint a marine engineer to superintend the filtration of 6 million gallons of water daily is not a proceeding that can be recommended. The vast importance of accurate measurements and absolute certainty in working shown on the automatic diagrams will be understood better, and their value more appreciated, when the offer of the prize of £30 for the best paper on filtration has been awarded in June next by the Institution of Mechanical Engineers—see "JOURNAL" for Nov. 26, p. 616.

I hope by calling attention to this matter in the "JOURNAL" the associate members may receive recognition.

Jan. 2, 1908. ASSOCIATE.

LEGAL INTELLIGENCE.

PENAL SERVITUDE FOR FALSIFICATION.

A Sad Case at Chorley.

At the Preston Quarter Sessions, last Wednesday, William Harris, late Head Book-keeper in the Gas Department of the Chorley Corporation, surrendered to his bail, and pleaded guilty to having falsified the gas ledgers of the Corporation, on March 31, 1903, March 21, 1904, Dec. 31, 1905, and Dec. 31, 1906, thereby defrauding the Corporation of £400. He pleaded not guilty, however, to a charge of having embezzled £37 6s. 1d.; and the prosecution did not proceed with this indictment. The facts of the case were briefly given in the "JOURNAL" for the 10th of December (p. 789), when the prisoner's committal for trial was recorded.

The prosecution was in the hands of Mr. Wingate Saul, who stated that it was prisoner's duty to receive moneys from the collectors from the penny-in-the-slot gas-meters. By falsifying one of the books, he was able to retain £100 each year. He gave every assistance in going through the accounts. His system of falsification was so ingenious that it was extremely difficult to detect, and hard for the non-professional mind to comprehend when explained. In fact, it was almost impossible to understand without viewing the ledger entries. On the occasion of the last audit, prisoner confessed to a deficiency of £150; but inquiries showed a deficiency of £600, of which £400 had reference to the falsification charges.

On the prisoner's behalf, Mr. Lindon Riley made a strong appeal for leniency, and urged the Court to give a noble exhibition of the proper application of the Probation of Offenders' Act. He attributed prisoner's downfall to laxity of supervision, a small salary, prisoner's own skill and ingenuity in the methods he employed, the fact that he had been in receipt of the cash collected in respect of the automatic meters and had also been the gas department book-keeper, and that the automatic gas-receipts were kept by prisoner, whereas they should have been entered in a separate book. He said the prisoner immediately admitted his deficiency on being asked to produce the cash. About £30,000 a year passed through his hands; while his salary was only £115 per year, though he had been in the employ of the Corporation for a period of twenty years. Prisoner had an excellent character, and supported not only his wife and three children, but likewise his aged father and mother.

Mr. Wingate Saul stated that prisoner only actually handled £4000 a year, though he dealt with £30,000 in figures.

The Chairman (Mr. Worsley Taylor, K.C.) said the case had been carefully considered by the Bench; and they thought it was a most persistent abuse of trust. While sorry for the prisoner, they had to deter other people from committing a like offence. He then passed a sentence of three years' penal servitude.

WILFULLY DAMAGING A GAS-ENGINE.

At the Worcester Quarter Sessions, last Tuesday, Frederick Smith, a labourer, was charged with doing wilful damage (under circumstances recorded in the "JOURNAL" for Dec. 17, p. 859) to a gas-engine belonging to the Kidderminster Gas Company. For the prosecution, Mr. Matthews explained that the prisoner was employed by the Company to load coal in trucks and wheel them to a lift, where, by raising a lever, an engine would be put in motion which would raise the platform to a higher level, where the trucks were run along rails to the stokers at the retorts. Between 9 and 10 o'clock at night on Sept. 28, the prisoner was engaged in his usual employment; and he seemed to have had an intention of putting the engine out of action, because he asked one of his fellow workmen to give him a hammer. Shortly after this, he asked his mate to fetch him a sledge hammer. The hammer was brought, and prisoner dealt several blows at the machinery, with the result that the levers and pistons were bent and broken, and the engine was stopped. The Company were put to some inconvenience; for they had to send about to get extra men to wheel the coal up the slope. The Manager (Mr. A. Dougall) was away; but as soon as he returned, he offered a reward of £2 2s. On Nov. 27 there was another occurrence of this sort; and the reward was increased to £5 5s., with the result that certain information was given to Mr. Dougall, and prisoner was suspended and proceedings instituted. Evidence bearing out this statement having been given, prisoner said that when he was nine years of age he had the side of his head knocked in. Consequently, when he had beer he did not know what he was doing. On the night in question, he went to work drunk and could not remember anything that happened. He was found guilty. The Chairman said prisoner had a good character. He advised him to keep off drink, and sentenced him to three months' imprisonment with hard labour.

DISPUTED REGISTRATION OF A WATER-METER.

At the Cheshire Quarter Sessions held at Knutsford last Wednesday, before Mr. H. C. Yates and other Magistrates, an appeal was heard, in which the Bredbury and Romiley Urban District Council were the appellants, and Martha Ward, George Gregory, and Joseph Townend Ward were the respondents, against an order of the Justices at the Stockport Petty Sessions determining that the sum of £54 17s. 4d., claimed by the Council for water supplied, was not owing, but only £2 15s. Mr. W. B. Yates appeared for the appellants; Mr. Banks represented the respondents. Mr. Yates said the respondents were hat manufacturers, and they had for a considerable time taken water in large quantities from the Council. From Dec. 25, 1906, to March 25, 1907, the appellants alleged, but the respondents denied, that 775,000 gallons of water had been used; and the charge for this quantity was £54 17s. 4d. To recover the amount they took out a summons under section 256 of the Public Health Act; and the Justices made an order on the respondents to pay £2 15s. and costs. The Council then gave notice of appeal, as the Justices never had their minds directed to what was the real point in the case. Respondents contended that the quantity of water charged for had never been used, and that the meter registration had been inaccurately taken. The Justices considered it would be fair to take the consumption in the corresponding quarter of the previous year, which was only 30,000 gallons; and for this they ordered payment. Mr. Yates submitted that the meter was correct and that the registration had been properly taken, and therefore that the respondents' contention fell to the ground. Mr. Samuel Axon, the Council's inspector, was called, and said he was confident he did not make a mistake in reading the meter. Mr. Banks said the bill for the quarter in question was more than 25 times the amount which had been paid for water in previous corresponding quarters. When his clients' attention was called to this, they said it was impossible they could have used the water; and from that day forward, when the registration was properly taken, it was found that for the rest of the quarter (one month) only 9000 gallons had been supplied. The only explanation possible was that there had been a mistake; and he submitted that the Justices were perfectly right in what they decided. Mr. J. T. Ward, one of the respondents, was called, and suggested as an explanation that in reading the meter the 282,000 put down as the number of gallons of water registered should have been 28,000. Other witnesses having been called, Counsel briefly addressed the Bench, who decided to allow the appeal. They therefore made an order upon the respondents for the amount claimed, with costs.

Mr. Jolliffe's Management of the Ipswich Gas Company.

Last Tuesday evening, the staff of the Ipswich Gas Company met at dinner in the Board-room, at the invitation of Mr. J. T. Jolliffe, in celebration of the twenty-first anniversary of his appointment as Engineer and Secretary of the Company. Mr. Jolliffe presided, and was supported by Mr. W. Alexander, J.P. (Vice-Chairman), Mr. Hugh Turner (one of the Directors), Mr. F. Prentice, and other members of the staff. Sir Daniel Goddard, M.P. (the Chairman), was unavoidably absent. After the loyal toast had been duly honoured, Mr. Jolliffe proposed "The Ipswich Gaslight Company," and gave some interesting statistics relative to the growth of the undertaking during the last 21 years, in which period the annual make of gas had nearly trebled, He said the success of the Company was chiefly due to the fact that they had always been fortunate in having for their Directors gentlemen of progressive spirit. Speaking of personal reminiscences, he paid a high tribute to the late Mr. Ebenezer Goddard, who was a pioneer in the manufacture of gas-cookers and gas-fires, and also to his distinguished son, Sir Daniel, their present Chairman, and his (the speaker's) immediate predecessor in office. He coupled with the toast the name of Mr. W. Alexander, the Vice-Chairman and "Father" of the Board, who, in reply, referred to the great increase which had taken place in the Company's business within his recollection, and said it had been largely brought about and provided for by a succession of excellent Managers. Referring to the immediate cause of the meeting, he said he considered the Directors were exceedingly fortunate in securing the services of so able an Engineer as their present Manager. Mr. Prentice proposed "The Directors," and referred to the Company's superannuation fund. Mr. W. Alexander proposed "The Staff," coupling with the toast the name of Mr. G. A. Mallet, who responded, and proposed "The Health of Mr. Jolliffe." In thanking him for entertaining them, Mr. Mallet expressed the hope that he would be spared for many years to continue in the management of the Company (a wish tangibly expressed a few weeks since, when the staff presented him with a silver bowl as a birthday gift), the success of which those present knew was in no small measure due to his ability as an Engineer and his wise administration as Manager, Mr. Jolliffe's watchword had been duty—to the public, the shareholders, the Directors, the workmen and officials—and he need not remind them how well he had done it. The toast was very cordially received. Mr. Jolliffe, in reply, called to mind the time of his appointment, when, at a gathering of the Company's employees 21 years ago, he said he would try to do his best in all directions; and he was glad to know that he had won the respect and confidence of those associated with him in the undertaking. He concluded by wishing all present "A Happy New Year." With the singing of "Auld Lang Syne," an enjoyable evening was brought to a close.

Increase in the Price of Gas at Croydon.—As from the Christmas quarter, the price charged by the Croydon Gas Company will be increased 2d. per 1000 cubic feet. In the Croydon portion of the district, the advance will be from 2s. 8d. to 2s. 10d.; and in the Caterham area from 3s. 4d. to 3s. 6d.

Christmas at the Chichester Gas-Works.—What has now become an annual function at the Chichester Gas-Works took place in the newly-erected club and recreation-room of the Company's employees on the Friday following Christmas. In the afternoon, the children of the workmen were entertained at tea, and enjoyed fun and frolic around a Christmas-tree laden with suitable presents for all, with the usual accessories of sweets, fruits, nuts, &c. Later on their elders—fathers, mothers, and grown sons and daughters—sat down to "high tea," and spent a most enjoyable evening together, under the presidency of the Engineer, Mr. T. E. Pye, who was supported by Mr. Vick, the Secretary, Mrs. Pye, Mrs. Vick, and the clerical staff. A telegram of congratulation from the Chairman (Mr. Alfred Lass) was enthusiastically received and replied to by all present, with their most cordial wishes for their Chairman's welfare. These annual gatherings are greatly appreciated by the workmen, and have doubtless contributed much to the present cordial relations existing between the Company and their employees.

MISCELLANEOUS NEWS.

POSITION OF THE BELFAST GAS UNDERTAKING.

The Proposed Extension.

The minutes of the Gas Committee which were adopted by the Belfast Borough Council, at their adjourned monthly meeting last Thursday, contained the following report, dated November, by the Gas Manager (Mr. Robert Sharpe), with reference to the necessity for an extension of the works, and the suitability of the ground proposed to be taken over in Ormeau Park for the purpose.

"It must be evident to the least informed observer that the site of the existing gas-works is already so overcrowded that there is not room to carry on the work in a safe or economical manner, much less to meet the rapidly increasing demand for gas, for any length of time. The urgent need for new works was brought before the Corporation in 1880, when the output was only 548 million cubic feet per annum; but no action was taken. A few years later, in 1891, a new retort-house was erected on the only spare ground in the works, and was followed by the introduction of carburetted water gas in 1893, which has proved so efficient as to keep us going up to the present, and save the cost of new works. Now, however, this water-gas plant has reached its limit, and is working up to its full capacity; and no extension of it is possible for want of ground to increase our purifying area in this section, already much too small for the volume of gas being passed—resulting in a daily loss of lime for want of the proper time-contact.

"As a matter of fact, while the producing power of the works has been increased all round, the other parts of the plant—especially the purifiers—in this water-gas section have been proportionately handicapped. For years past the ground and floor area in this house have been very much too small to admit of properly preparing or disposing of the purifying material. Our difficulties on this score alone in mid-winter are most acute; and the failure of any portion of the plant at this season would produce disastrous results, and involve the Corporation in costs that would pay the rent of many acres of ground. In this connection, I would draw your attention to the unstable and dangerous condition of the walls of this purifying-house, which may put us in the position just referred to at any moment. A large portion of a side and end wall has been sinking for some time owing to bad foundations; and in the last fortnight the settlement has opened considerably the rent in the wall, which extends from top to bottom. These walls support the purifying-boxes, which deal with one-half of our output; and it is obvious that any failure at this point would not only put the town in partial darkness, but have lamentable consequences. Our gasholders when all full would only supply the town for half a day at our maximum output; whereas we should have storage for at least 1½ days, which is the usual allowance for a large manufacturing town like Belfast. These references are but a poor epitome of the enormous difficulties and risks we have to contend with during the stress of the winter months, due entirely to the congested state of the works for want of sufficient ground space. In a large concern like the gas-works, it is desirable to have abundance of ground space if we are to produce economical results. This principle is given effect to in all modern gas-works; and a splendid illustration of this was seen in the new works at Berlin and Cologne, which were inspected by the members of the recent deputations.

"Our gas consumption, as you are aware, is growing rapidly; and the following figures will serve to show the rate of progress in the last 27 years, taking five-year periods from 1880 to 1905, and 1906 and 1907 as single years:—

Year.	Output.
1880	548 million cubic feet.
1885	718 ,, ,,
1890	978 ,, ,,
1895	1169 ,, ,,
1900	1305 ,, ,,
1905	1816 ,, ,,
1906	1916 ,, ,,
1907	1969 ,, ,,

These figures show an increase of 259·39 per cent. between 1880 and 1907, or an average increase of 9·6 per cent. each year, which practically means doubling the output of gas every ten years.

"Now, as regards the spare plant we have available to meet this increase. On a December day, our water-gas plant is working up to its full capacity, leaving only 432 spare coal-gas retorts to count upon, with a producing power of 1261 million cubic feet per annum. Taking as a basis the output of last year, amounting to 1969 million cubic feet, and counting on a yearly increase of 8 per cent., our spare retorts would tide us over only six years' maximum requirements—and that, be it noted, with the last retort working. It must be obvious that to postpone extensions till the producing power is pushed to this, the very last extremity, would be most unwise. Of these 432 retorts, 288 are in our largest retort-house, which, as you are aware, is under an injunction, and might not be available unless we can abate the nuisance complained of. This would reduce the spare retorts to 144, and would only suffice to meet the increase for two years. Grave responsibilities as gas suppliers attach to the Corporation by their Acts of Parliament. You are bound to supply the community with gas under a penalty of £2 per day in every case where you fail to comply; but, irrespective of such considerations, before new works can be erected it will take one year to obtain the necessary parliamentary powers, and not less than three years to erect new works, so that it is absolutely imperative that immediate action should be taken to secure the necessary ground for extensions, if the Gas Committee are to fulfil their statutory obligations.

"Turning now to the question of site, this was reported on by two eminent engineers—Mr. Corbet Woodall and Mr. William Foulis—who were of opinion that there was no ground in the neighbourhood of Belfast so suitable for the construction of gas-works as the low-lying ground in the Ormeau Park. It is a first condition that the works must be on the river side, to ensure the cheap delivery of coal by lighters. The proximity of this ground to the existing works and to the river places it beyond comparison; while the nature of the ground is such as to ensure good foundations. Our existing works cover an area of 13¾ acres; and the maximum output may be taken as close on 11 million cubic feet per day. In providing for new works, it rests with the Corporation to say how many years ahead they will provide for. I venture to suggest that provision for the next twenty years would only be a reasonable allowance, and that the new works should be equal to an ultimate make of 20 million cubic feet per day, or twice our present requirements. The works would be arranged in 4 million sections, starting with the first section, and adding the others systematically as required; thereby involving only a gradual outlay of capital. The manufacturing portion would be closer to the river at the north end of the site, and would then be little nearer the park than the existing works on the other side of the river. The retort-houses would be practically smokeless, and the amenities of the park not interfered with. A roadway bridge would be thrown across the river to connect the existing works with the new station, and a new roadway made from the bridge to the Ravenhill Road. This would confer a great boon on a large number of people. As regards the area of ground to be required, works of an ultimate capacity of 20 million cubic feet should have, at the lowest estimate, 32 acres, or if a greater area can be had so much the better; and in lieu of this, an equal area of the higher and better ground at present reserved for letting might be given to the public in exchange. The cost of the first portion of the works complete, including bridge and roadway, I estimate at £435,000."

In moving the adoption of the minutes, Mr. J. A. Doran, the Chairman of the Gas Committee, emphasized the need of extending the works, and pointed out at length the suitability of the proposed site in Ormeau Park. Other members, however, said they regretted that a discussion on the matter had been opened that day; and Mr. M'Clure drew attention to the fact that, with regard to the Manager's report, there was no resolution and no finding of the Committee. During the long discussion that took place, strong opposition to the proposed site was manifested; but Alderman Sir James Henderson maintained that the only objection which could be made to the ground in question was a purely sentimental one. Ultimately, the matter was allowed to rest for the time being, on Mr. Doran assenting to a suggestion to have the ground proposed to be taken marked out in some way for the information of the members.

THE DUBLIN GAS STRIKE.

Men Returning to Work.

The welcome news was contained in last Thursday's "Freeman's Journal" that, through the intervention of Sir Antony MacDonnell, the Under Secretary for Ireland, the employees of the Alliance and Dublin Consumers' Gas Company who had been on strike had decided to apply for re-instatement in the works. It was reported that about 160 men would be applying in this way, and would be employed at the discretion of the Company.

In the course of an interview with a representative of the paper, which was published in the same issue, Mr. W. F. Cotton, jun., the Chief Engineer of the Company, made the following statement: "This settlement means an unconditional surrender on the part of the men. Up to this morning, we had taken back 46 of those who had gone out on strike on the old terms; and to-day 62 more of the men were taken back by us. That makes 108 of the strikers whom we have taken back on the same terms as formerly. At the same time, the men who have come in to serve the Company during the strike are not to be turned away. They will be retained; and we will try to fill all the vacancies from the ranks of those who went out on strike as soon as possible. By the end of the week, we expect to have everything in proper working order again. Though it is not skilled labour, it takes the new men a little time to become expert. At first everything seemed to favour the strikers. They took advantage of the advent of Christmas, hoping to embarrass us. We were resolved that, whatever happened, Dublin should not be left in darkness; and every nerve was strained to see that a sufficient quantity of light was supplied. Of course, the paralysis of business caused by a failure of light would be terrible. We will take back all the men we can; and it is hoped that in one way or another practically the whole of the strikers will be provided with some kind of employment before long. The men are glad to get back, having been taught a lesson; and the termination of the dispute will, I think, have a healthy effect all round."

A letter was also published from the Secretary and Manager (Mr. Francis T. Cotton), in which the writer said he was instructed by the Directors to express their extreme regret for the serious inconvenience caused to customers just recently, owing to an inadequate supply of gas, and to say that all possible efforts had been made to keep up the supply. He added that there was every prospect of matters resuming their normal condition within the next few days.

The Law Committee at their last meeting had before them a report from the City Gas Examiner (Mr. T. J. Cotton), stating that during the preceding week the gas distributed through the mains was highly charged with sulphuretted hydrogen; and that it contained a quantity of free oil, and in some instances was supplied in a crude state. The illuminating power on Dec. 31 was only equal to 11·7 candles. The Committee also had a report from the Official Gas Examiner appointed by the Board of Trade dealing with tests made during December, and stating that the gas lately had been full of sulphuretted hydrogen and carbonic acid. His test of Dec. 31 showed the illuminating power to have been only 11·8 candles; and on that date he found a considerable quantity of sulphuretted hydrogen in the gas. At the request of the Committee, Sir Charles Cameron, C.B., M.D., the Public Analyst, made some tests of the gas, and confirmed the report of the City Gas Examiner as to the presence of considerable quantities of sulphuretted hydrogen. It was decided to ask the Law Agent to report what steps the Committee had power to take; and it was also determined to hold a special meeting to further consider the matter.

GAS AFFAIRS IN MANCHESTER.

Experiments with Inverted Gas-Burners.

In the course of a notice of local events during the past year, the "Manchester Guardian" makes the following remarks with regard to the new gasholder now being put up at the Bradford Road works, and the progress of the inverted burner.

The construction has been begun of a quite gigantic gasholder at the Bradford Road works. The holder when completed will be the second largest in the United Kingdom. It will be 285 feet in diameter and 46 ft. 6 in. in depth; and its holding capacity will be 10 million cubic feet. At present, the largest gasholder belonging to the Manchester Corporation is one of 7 million cubic feet capacity, also at the same works. The largest of the other holders in Manchester does not exceed in holding capacity 1,700,000 cubic feet. The cost of the latest and largest tank and holder is estimated at £100,000. Another work of considerable moment which the Gas Committee have in hand is the completion of the inclined-retort house at the Gaythorn works. It is worth noting in connection with the gas industry that a great exhibition of gas-using appliances was held recently in St. James's Hall. How gas can be employed to the best advantage for lighting, heating, cooking, and power purposes was shown; and popular lectures were delivered by well-known experts in gas-making. All this, it is believed, will stimulate the demand for gas in the city and surrounding districts. The inverted burner as a light-giving agent seems to gain in public favour; for its use is undoubtedly becoming more general. It is said to give a better light at less cost than other form of light. Certainly it is not without significance that the Gas Committee are contemplating the substitution in their own offices of inverted burner lamps for the electric lights which have been in use for a long time. In St. Peter's Square the Committee are trying the effect of inverted-burner lamps as compared with intensified gas for lighting up large spaces. If the experiment is successful, we may expect soon to see the inverted burners in use at the junctions of main roads, and probably in the principal streets.

LONGTON CORPORATION GAS UNDERTAKING.

Reference to the past municipal year at Longton could not, of course, be by any means complete without allusion to the gas undertaking; and on this branch of the Corporation work, the "Staffordshire Sentinel" makes the following remarks.

The gas-works have shown an increasing output; and when the department was being discussed at the federation inquiry in February, expert evidence was given that, so far as manufacture and storage are concerned, the Longton works have a capacity for supplying 75 per cent. more than at the present time, without any extension of plant. This position has been attained mainly by the increased efficiency of the works under Mr. W. Langford's capable management, and the installation of the water-gas plant. There has been no addition to the capital account of the undertaking during the last eight years. The gas-works have again been the Corporation milch cow; and £2500 was handed over last March to the relief of the rates. Prior to the recent increases in the price of coal, the Committee had been considering a substantial reduction in the charge for gas; and they were disappointed in not being able to carry out their wishes. The matter remains in abeyance until the coal market resumes its normal condition, when it is hoped to recommend a tangible reduction; but in the meantime there has been no increased charge to consumers. A notable feature of the past year has been the large development of the slot-meter system among the houses of the working classes. This has been so great that at times it has been almost impossible to meet the demand for the installation of fittings, though the staff have been continually employed. The Committee appreciate this form of business, as it spreads the consumption over a larger field, and the output is not so liable to fluctuation as when it is dependent upon large consumers whose demand may suddenly cease or be influenced by industrial conditions. The conveyance of gas to Barlaston (which is within the area of supply under Act of Parliament) is now under consideration; and the Manager is preparing estimates as to the cost of mains, and also approximating the demand. No engineering difficulties are in the way of the scheme, it is stated; and the village can be supplied with a good pressure, although the difference in levels is rather great. The question of a guaranteed demand will influence the Committee in the decision to proceed with or defer the work.

The East Hull Gas Company.—The Hull "Daily Mail," in the course of an article on "Humber Trade and Commerce in 1907," says: Gas shares do not show much alteration; the profits being steadily maintained. The name of the Sutton, Southcoates, and Drypool Gas Company was changed in the early part of the year to the East Hull Gas Company. The shareholders in the old concern received, for each £10 share held, an allotment of £15 of 5 per cent. stock in the East Hull Gas Company. The price of the latter is quoted at about 101-103; but it only changes hands occasionally, as it forms a first-class security, and is well held by investors.

Water Supply of Creswell.—It is reported that the Water Committee of the Clown Rural District Council have met Mr. Houston, of the Bolsover Colliery Company, with reference to the proposed water scheme for Creswell. It was, after considerable discussion, decided to recommend that the offer of the Duke of Portland be accepted. This offer was that the Duke would build a reservoir on the top side of Creswell, and lay the necessary mains, &c., from Welbeck, and supply the water, which would be from the Bunter Bed, at a cost of 9d. per 1000 gallons. It was suggested that the Rural Council should take over the mains of the Colliery Company, and that the other property should be connected up with the new water as soon as possible. With reference to the Committee's decision, they bore in mind that recent analyses of the Creswell water had proved it to contain animal matter.

PUBLIC LIGHTING AT TUNBRIDGE WELLS.

Proposed Further Substitution of Electric for Gas Lamps Withdrawn.

At a Meeting of the Tunbridge Wells Town Council last Wednesday, a long discussion took place with regard to the substitution of electricity for gas in the public lamps. There were two points before the Council; and the first of them was a resolution to transfer the supervision of the public lighting from the Lighting Committee (who have control of the municipal electricity undertaking) to the Watch Committee. The second matter was the following letter, which had been received from Mr. C. F. Catt, the Secretary of the Tunbridge Wells Gas Company.

> The attention of the Directors has been drawn to the report in the Press of the proceedings of the last Council meeting, with reference to the proposal of the Lighting Committee to substitute 200 electric lamps in place of a similar number of those at present lighted by gas under the incandescent system; and I am instructed to inform you that in the event of the number of incandescent gas-lamps being reduced, as proposed, the future charge will be increased by 5s.—viz., from £3 9s. 4d. to £3 14s. 4d. per lamp per annum.
>
> At the same time, should the Council resolve to continue the existing incandescent gas-lamps for another year from June 30 next, the Directors are prepared to reduce the charge by 5s.—viz., from £3 9s. 4d. to £3 4s. 4d. per lamp per annum—which represents an annual saving in the public lighting by gas of over £145. Or, further, if the Council will undertake to enter into a three years' agreement on the same terms and conditions as the present contract for the existing lamps, the Directors are prepared to reduce the charge by 7s. 6d.—viz., from £3 9s. 4d. to £3 1s. 10d. per lamp per annum. This reduction means a saving in the public lighting by gas of about £215 per annum.

The resolution was moved by Alderman Ryder, who said he thought the present situation was an immoral one; the seller ought not to be the buyer as well. The public lighting should be in the hands of an independent Committee, able to impartially judge the respective values of different illuminants. He did not believe that if the public lighting passed to the Watch Committee the Lighting Committee would lose any of their business. Alderman Barton contended that the argument of Alderman Ryder in favour of the motion was that it was sometimes advisable to use gas in place of electricity for public lighting. This being so, the Lighting Committee would be an interested party, inasmuch as it would be to their interest to use the electric light rather than gas. This was indirectly a suggestion that the Lighting Committee ought not to be trusted. Alderman Ryder, however, replied that he had carefully avoided any such suggestion. Mr. Carpenter said the only so-called argument in favour of the motion was that the Lighting Committee had done their work very well. Personally, he should be extremely sorry to see the town lighted in the same way that it was when he became a member of the Council. The proposals of the Committee had always been passed by the Council, who had raised no objections at the time. That day they recommended certain new lamps, with an equal division between gas and electricity. Mr. Richards thought it was a poor argument to say the Lighting Committee were sellers and buyers too. The Lighting Committee was a part of the Council, and had certain duties to perform; but, after all, the Council held the control. If they took the management from one section, and gave it to another, the Council still remained in control; and they were buyers and sellers too.

These speakers were followed by Alderman Delves, who impugned the policy of the Lighting Committee, and said he would prove their schemes to have been extravagant. To do so, he would take two or three instances, beginning with Mount Ephraim. There ten arc lamps were placed in a distance of 900 yards, at a cost of £210 a year. Of this, £170 was expended before 11 o'clock at night. In another 705 yards of road there were twelve arc lamps and one small lamp, costing £256. He had no doubt that if an independent Committee controlled the lighting without reference to gas or electricity, they would adopt a different system, and save £250 in the two thoroughfares. Crescent Road and Church Road were in the same category. Since the arc lamps had been put up there, the cost had more than doubled, though there was no traffic to justify it. The arc lamps were costing £1659 a year for half the night, which was an exorbitant charge. The cost of lighting twelve years ago was £2710; whereas last year it was £4650—a rise of nearly £2000. If they took into consideration the fact that in this time the price for gas had been reduced 7s. or 8s. a lamp, could they say there was anything to justify the increase? There were about six miles of new roads. If they took it from the point of view of rates, they would see that in 1895 lighting cost less than a 3d. rate; now it was more than 4d., notwithstanding that £76,000 had been added to the rateable value. With regard to the new roads, most of them were on the outskirts of the town. They did not require, and did not have, anything like the proportion of light that the streets did in the interior of the town. The proportion of rise due to new streets should not be in proportion to the cost of lighting the old streets. The Committee, after twelve years, had raised the cost of lighting by £2000 a year, and would require to defend their policy. There might be more light—and, of course, there was more—than there used to be; but was it worth £2000 a year? Excluding new streets, the actual increase in the cost of lighting the town was something like £1200 to £1400 a year. And he asked whether the improved lighting was worth £1200 a year to the ratepayers. He thought the general body would be far more pleased to have a reduction in the rate than the extra quantity of light. It was true that in the last five years the Committee had not increased the lighting bill very much; but they were so active in the earlier period of their existence that there was really nothing much left for their successors to do. The Committee, by adopting a different policy, and discarding the arc

lamps altogether, and installing a new system of electric glow lamps, could save at least £600 or £700 a year; and the town would be better lighted. Nearly all large towns were discarding arc lamps, recognizing that they were not a good form of street lighting. The present arc lamps were supposed to be 1600-candle power. They might be; but it was not a very effective light.

Replying to this criticism, Mr. Rule contended that for some years after electricity was installed, the undertaking worked at a disadvantage, from the fact that lamps had not been discovered which would give the necessary power at a cheap cost. This was not so now; and the Lighting Committee were able to charge the same price as the Gas Company. He defied anyone to show that this was extravagant. The whole town had been talking about the necessity for making Tunbridge Wells more attractive to visitors; and practically all towns that tried to make themselves attractive adopted arc lighting. As a large ratepayer, he objected to the reactionary policy of discarding arc lamps. If the arc lamps cost a penny rate more, he believed the money came back another way. He failed to see how public lighting could be better controlled by the Watch Committee.

Mr. Hyde pointed out that what was wanted was another Committee, who would bring the Lighting Committee and the Gas Company into fair competition for the benefit of the ratepayers. It was not to the benefit of the ratepayers that the profits of the electric light undertaking should be buoyed up by improper profits made at the expense of the ratepayers. More profit was made by the concern out of public lighting than out of private consumers. It was natural, therefore, that the Committee should endeavour to obtain as much of the public lighting as possible. To show how fair and impartial they had been, they proposed to convert 200 gas-lamps to electric-lamps at the same price as was charged by the Gas Company. They did this without asking the Gas Company to reduce their price. The Company then offered to light them at 7s. 6d. a year less than the Electricity Committee. This showed that the Gas Company were willing to compete; and the Committee proved their lack of independence in not asking them to do so.

The discussion was then effectively taken in hand by Mr. Wesley Smith, who remarked that the policy of the Committee had been one of gradual displacement of gas-lamps by arc and glow lamps. The sum now spent on electricity was £2565, and £2085 for gas—a total of £4650. In 1895, the cost was only £2710. The road mileage was then 39, so the cost per mile was £69 10s. In 1907, the road mileage was 48½; and the cost per mile now was therefore £96. Since 1895, there had also been a reduction in the price of gas equal to £250; so that though the argument might be made that there had been an improvement in the lighting, the fact still remained that, despite the considerable reduction in the price of gas, the cost of lighting had increased by £26 10s. per mile. This was mainly due to the displacement of gas-lamps by arc and glow lamps. The actual extra cost was £1244. The Engineer said that 218 electric lamps, including arc lamps, had displaced 278 gas-lamps. Of the 218 electric lamps, 79 were arc lamps, leaving 139 glow lamps at £3 19s. They cost £549 1s. The 79 arc lamps, at £21 each, cost £1659; the total being £2208 1s. The 278 gas-lamps, at £3 9s. 4d., would cost £963 14s. This left an increased cost of £1244 7s. This had been the costly policy of the past. He was not asking specially for the Watch Committee to control the public lighting, but for an independent Committee to do so. The present dual position of the Lighting Committee was an onerous one; and he should have thought the members would have been glad to be relieved of the position. They must realize that there was a temptation to run the undertaking for all it was worth, and not to take into consideration the interests of the general body of ratepayers.

Among other speakers, Mr. Edwards argued that the Lighting Committee did invite competition. They proposed to convert 200 gas-lamps to electricity; and the Gas Company immediately came tumbling down in price. The Mayor's advice to the town was to wake up; but to go back to gas was a fine way of waking up. Mr. Hicks said that, as a business man, he had always held that the Lighting Committee should not have the control of the public lighting. Such a state of affairs would not prevail in any business community. The fact was that the Committee were paying themselves a larger sum per lamp than they were paying for gas.

The motion was then carried by 11 votes to 10. The proposal to convert 200 gas-lamps to electricity, adjourned from the previous meeting, was withdrawn.

GAS PROFITS AND THE RATES AT WIDNES.

The Corporation Bill.

Naturally, the clause in the Widnes Corporation Bill by which power is sought to vary the existing Act so as to allow of gas profits being handed over for the relief of the rates, is exciting much interest locally; and equally naturally this interest is reflected in the "Correspondence" columns of the Press. At noon to-day the public meeting of the electors is to be held at which the Bill will be considered and voted upon; but even this is unlikely to put an end to the controversy. Meanwhile, one or two points from letters that have appeared may be reproduced to show what some, at least, of the ratepayers think of the proposal.

In the course of a lengthy communication to the "Widnes Weekly News," Mr. L. Boyle says: "Widnes has been looked upon in the past as being the ideal of municipal enterprise in so far as we produce the cheapest gas in the world. Widnes stands out as the best advertisement I know for municipal trading to every other municipality; but still I consider the advertisement would be even greater if the profits were utilized either for the improving of the quality of the gas, or the cheapening of the present quality. Sufficient would have been left for a sinking fund if the gas of 1907 had been supplied to the consumer at 1s. 1d. per 1000 cubic feet. Bear in mind that I do not strictly advocate this. Rather would I see the money allocated for further municipal extensions (which, by the way, are very needful in Widnes); but, in all justice to the gas consumer, it should not be taken for the relief of the rates. . . . Judging the matter from the point of fair municipal trading, the gas-works and its effects really belong to the gas consumer; and he is asked, as a burgess, to assemble at the Town Hall, on Tuesday, at 12 o'clock, to make a declaration. Ninety-five per cent. of the gas consumers and burgesses are working men; and yet they are asked by their Mayor, aldermen, and councillors to meet at such a ridiculous hour. I wonder is this intended for a huge joke, or were our city fathers really in earnest? They'll teach us to hold protest meetings. We know the result of the meeting before it is voted upon. The majority of the workers are asleep, and are being unconsciously robbed."

A letter by "B" concludes in these terms: "The position of the Widnes gas undertaking is a remarkable example of the potency in business of the one necessary man. The success is without doubt due to the extraordinary skill in management of the Gas Engineer, combined with the sound financial policy adopted by the Gas Committee and Council, under which extensions have been effected out of revenue, and not out of capital. I think the majority of gas consumers will have some hesitation in accepting the suggestion that the present results might have been achieved had the Council had power to apply surplus revenue for other purposes. It is only by the continuance of the existing policy that Widnes can maintain its present paramount position in the gas world. Forty years ago it was recognized that the gas concern was a trust to be administered by the Local Authority for the benefit of the gas consumer; and lapse of time is a very poor excuse for violating the trust. It is unfortunate that the public meeting has been convened for an hour at which it is impossible for working men to attend without suffering pecuniary loss; but no doubt some one will be present to demand a poll."

Arguing on the same side, "Triptolemus" says: "The gas consumers by slot meter make, and have made for several years past, the major portion, if not the whole, of the surplus profits on the gas undertaking; and it is not just to use these profits for the benefit of others who do not assist in making them. About 3000 houses in Widnes are owned by persons who do not reside in the borough, and who do not burn gas. They have very little interest in the town beyond drawing their rents. Railway companies, building societies, and similar concerns will benefit at the expense of the poorest portion of the inhabitants, if the gas profits are taken for the reduction of the rates."

ROBERTSBRIDGE WATER AND GAS COMPANY.

At the Annual Meeting of the Robertsbridge, Salehurst, and Hurst Green Water and Gas Company—held last Saturday week at Battenhurst Park, Burwash (the residence of Mr. E. Eaton), under the chairmanship of Dr. Allan Maclean—the motion for the adoption of the report, which was noticed in last week's "JOURNAL," was seconded by Mr. Eaton.

Mr. Eaton, after explaining the reasons which had led the Company to supply Robertsbridge with water before any other portion of the area, said they had just completed laying mains in another part of the district which was equal in importance to Robertsbridge, and that was Hurst Green. With regard to the discoloration of the water, that was a matter which was beyond their control; but, as stated in the report, it held in check the growth of the business, because the water contained what was alleged to be an excess of iron. While being perfectly wholesome and healthy, it did not quite meet the tastes and palates of some individuals, who thought that, because the water was somewhat highly coloured, it was therefore undesirable. He was glad to say the difficulty had now been surmounted. Steps were taken to meet the objection; and the water now was as clear as any water one could desire to obtain. It was next decided to erect gas-works at Robertsbridge. A site was negotiated in the district; and a deposit was paid by the Company on the contract for the purchase of it. Inquiries were made around the district as to what likelihood there would be of a nuisance with regard to the gas-works; and they were told there would be none at all. One fine day, however, a gentleman took it into his head to raise some objection; and they did not wish to contest the matter with him, though he thought they had a very strong case. In the interests of the shareholders, they looked about to see if they could find a site equally as good; and he was pleased to say they found one which was better. The works were commenced immediately; and they were now completed, and would shortly be supplying gas to the mains. Both the Burwash and Etchingham districts were waiting and anxious to have a supply of gas; and in anticipation of a supply of both water and gas, building operations had taken place.

The report was adopted.

Potteries Federation Scheme.—A poll has taken place at Tunstall with reference to the proposal to amalgamate with other Potteries towns; and the result was a majority of 254 votes in favour of the federation scheme. The total number of votes recorded was 1539, out of a possible 4614. Some surprise has been felt at the result in certain quarters, for hitherto the Tunstall Urban Council have strenuously opposed the movement.

Progress of the Birmingham Gas Undertaking.—In a sketch of the work of the City Council during the past year, the "Birmingham Daily Mail" refers to the gas undertaking in the following terms: The year has been marked by steady progress; the increase of output being quite satisfactory. Including the amount contributed for public lighting, for which a charge of 1s. per 1000 cubic feet only is made, the city benefited to the amount of nearly £75,000. Two-thirds of this sum (£57,563), went directly to the relief of the rates. Some idea of the magnitude of the department may be gathered from the fact that the income exceeded £900,000, and that 560,000 tons of coal were used in gas manufacture. The debt on the city is about £2,250,000; and the profit is equal to 3⅓ per cent., after paying interest and making provision by sinking fund for liquidating the debt.

PREVENTION OF ATMOSPHERIC POLLUTION.

A recent issue of the Engineering Supplement to "The Times" contained an article by Mr. B. H. Thwaite on "The Pollution of London's Atmosphere," in which he brings forward a proposition for its prevention.

Mr. Thwaite begins by taking the figures of the annual consumption of coal in the Metropolitan area, as given in evidence before the Royal Commission on Coal Supplies, at about 14 million tons, and then comes to the conclusion that the pollution of the atmosphere of London means a loss, as the result of imperfect combustion and the waste of hydrocarbons and ammonia, equivalent to several millions sterling. He goes on to point out that nearly twenty years ago he elaborated a scheme for generating fuel gas on the coalfields, and separating the hydrocarbons and ammonia—the gas to be supplied under high pressure on the lines of the natural gas distribution in the United States. Somewhat on these lines, an installation has, he says, been erected at Camden (Philadelphia). It consists of a bye-product coke-oven gas-generating plant, the volatile gas from which is conveyed (at 6 lbs. pressure) to Fenton, several miles distant, and is used in gas-fires and for lighting by means of mantles. Its illuminating value is very low—probably only 8 to 10 candles. Four years later, the lowering of the standard of light of the Metropolitan gas to 10 to 12 candle power, to take full advantage of the incandescent system of burning gas, was advocated by Mr. Thwaite in order to remove the necessity for expensive enrichment, and to secure a reduction in the price of the gas, both for heating and lighting purposes, besides reducing the proportion of moisture in the products of combustion. The lowering of the illuminating power from 17·4 to 14 candles, thanks to the South Metropolitan Gas Company, had since followed. The establishment of bye-product household coke-oven stations outside the Metropolitan area with associated machinery and apparatus to distribute gas of low candle power to the existing Companies, and to generate bulk electricity from the refuse coke and coal for distribution to existing Metropolitan electric stations, was proposed by Mr. Thwaite in 1905.

Among the triumphs of applied science that provide agencies which Mr. Thwaite says may be "harnessed to the great service of preserving the purity of the atmosphere in our large centres of population, and all of which have been practically perfected within the last thirty years," he places the following: (1) The perfection of the electric generator and motor. (2) The transmission of electrical energy over long distances. (3) The electrification of city railways. (4) The increase in the power capacity and perfection of gas-engines capable of driving electrical machinery in parallel and of securing a thermo-dynamic efficiency of over 30 per cent. (5) The introduction by Welsbach of the mantle-burner, permitting Bunsen's combustion system to be used for gas lighting. (6) The introduction of the prepayment gas-meter. (7) The economic distribution of coke-oven gas under high pressure. (8) The perfection of coal-coking processes, by which a high thermal efficiency is secured along with the recovery of the hydrocarbons and ammonia. (9) The principle of partial coal distillation to secure the easy ignition, and with some degree of flame, of household coke. "We may therefore hope," he says, "that the light of science may soon dissipate the canopy of darkness that has converted our large British manufacturing centres in the long winter months into centres of misery and mental depression."

WATER SCHEME FOR GLAMORGAN.

Proposed Constitution of a Central Authority.

The Glamorgan County Council (bearing in mind the need of properly utilizing and preserving as far as possible the sources of water supply within the county, and of acquiring legal rights over any available gathering areas outside to provide for future requirements) have under consideration a scheme for the constitution of a Central Authority for the supply of water to the whole of the Administrative County; and it is also suggested that the City of Cardiff and the County Borough of Swansea should be included. The scheme is dealt with at length in a report by Messrs. Middleton, Hunter, and Duff, of Westminster, from which the following particulars are taken.

The population of the administrative county in 1906 was estimated to be 664,153, and that of Cardiff and Swansea at 285,500; the total estimated population being 949,153. The Engineers estimate that 20 gallons per head per day should be provided; and they believe that the supplies of water drawn from the coal measures will be gradually reduced in quantity, and will be of less than half their present volume at the end of 44 years. On the basis of 20 gallons per head per day, there is already a big deficiency within the administrative county in the amount of water actually delivered. Without an efficient means of treating the supply of water to the administrative county, and without a combination of interests such as the proposed Water Board would effect, it is believed that this deficiency must go on increasing. The districts which are at present supplied with more than 20 gallons of water per head per diem are Cardiff, Merthyr Tydfil, Swansea, Barry, Bridgend, Briton Ferry, Margam, Penarth, and part of Llandaff and Dinas Powis rural district. Portions of other districts are moderately supplied; while some parts have little (if any) public supply. The result of their investigations points conclusively to the formation of a Water Board for the whole county, including Cardiff and Swansea. Within the administrative county, where the needs of the population are the greatest, the advantages to be secured by the formation of a Water Board to look after the water interests of the county as a whole, are so obvious as to require but little demonstration. Most of the streams of the county are polluted from their sources; and both springs and streams, most of which are situated on the coal measures, are liable to be absorbed into coal workings, rendering the bounteous rainfall of the district for the most part useless for purposes of water supply. Owing to the geological formation of the county, there are few sites available for reservoirs; and large reservoirs on permeable strata can, as a rule, be constructed at much less cost per million gallons than a number of small ones of equal aggregate capacity.

As to whether Cardiff and Swansea should be included in the scheme, the report states that it might be said they had nothing to gain by combination; but this is a mistake, and Cardiff and Swansea might reap much advantage by joining a general scheme. Cardiff is proceeding to construct a new reservoir in the Taff Vawr Valley at considerable cost; and the Engineers estimate that, should the city stand aloof, it will be necessary in about ten years' time for Cardiff to build another and much larger reservoir, which would complete the works requisite for impounding the whole of the available water of the Taff Vawr, and would, when finished, provide for the requirements of Cardiff and district until 1952 or later. If Cardiff joined the proposed

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 15.

Issue.	Share.	When ex-Dividend.	Dividend or Interest & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Oct. 11	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
268,324	10	,,	7⅞	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	Oct. 30	7	Bombay, Ltd.	6½—6¾	..	5 3 8
40,000	5	,,	7	Do. New, £4 paid	4½—5	..	5 12 0
50,000	10	Aug. 29	14	Bourne-mouth Gas and Water	10 p.c.	..	4 18 3
51,810	10	,,	7		B 7 p.c.	..	4 2 4
53,200	10	,,	6		Pref. 6 p.c.	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	243—248	..	5 0 10
300,000	,,	,,	9⅜	Do. New	181—186	..	5 2 2
50,000	,,	,,	5	Do. 5 p.c. Pref.	115—120	..	4 3 4
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb.	98—101	..	3 19 3
220,000	Stk.	Sept. 27	11¼	Brighton & Hove Orig.	200—210	..	5 7 1
246,320	,,	,,	8¼	Do. A. Ord. Stk.	153—158	..	5 4 5
460,000	20	,,	10	British	40—41	..	4 17 7
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	117—120	..	5 0 0
165,700	,,	,,	4⅜	Do. do. 3½ p.c.	87—90	..	5 0 0
500,000	10	Oct. 11	7	Buenos Ayres (New) Ltd.	10½—11½	..	6 4 5
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb.	89—91	..	4 7 11
150,000	20	July 12	8½	Cagliari, Ltd.	26—27	..	6 2 3
100,000	10	—	—	Cape Town & Dis., Ltd.	6—8	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	7—9	..	5 0 0
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
103,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	52—94*	..	4 15 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	108—110	..	4 10 11
1,443,280	Stk.	,, 29	5⅛	Commercial 4 p.c Stk.	100—105	..	4 19 0
560,000	,,	'	5	Do. 3½ p.c. do.	98—103	..	4 17 1
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	80—82	..	3 13 2
800,000	Stk.	,,	6⅜	Continental Union, Ltd.	106—111	..	5 17 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	135—140	..	5 0 0
460,170	Stk.	—	5⅜	Derby Con. Stk.	122—123	..	4 9 5
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
486,090	10	July 31	12	European, Ltd.	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	16½—17½	..	5 2 10
15,181,590	Stk.	Aug. 15	4⅛	Gas-light and Coke	4 p.c. Ord.	96—97	+1⅛ 4 10 10
2,600,000	,,	,,	3⅛		3½ p.c. max.	86—88	.. 3 19 7
3,799,735	,,	,,	4		4 p.c. Con. Pref.	102—105	.. 3 16 2
4,193,975	,,	Dec. 13	3		3 p.c. Con. Deb.	81—83	.. 3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.		93—98	.. 5 2 0
82,500	,,	,,	6⅜	Do. do. 5 p.c.		114—117	.. 5 11 1
70,000	10	Oct. 11	11	Hongkong & China, Ltd.		19—20	.. 5 10 0
4,940,000	Stk.	Nov. 14	8	Imperial Continental		171—174	+2½ 4 12 0
473,600	Stk.	Aug. 15	3⅛	Do. 3½ p.c. Deb. Red.		91—93	.. 3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.		110—120	.. 5 0 0
306,083	,,	Dec. 30	4	L'rpool Unit'd Deb. Stk.		106—108*	.. 3 14 1
£			p.c.				£ s. d.
561,000	Stk.	Aug. 29	10	Liverpool United A		220—222	.. 4 10 1
718,100	,,	,,	7	Do. B		158—160	.. 4 7 6
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.		140—145	.. 5 5 2
75,000	5	Nov. 28	5	Malta & Medn., Ltd.		4—4⅛	.. 5 11 1
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.		99—101	.. 4 19 0
250,000	100	,,	4⅛	Melbourne 4½ p.c. Deb.		100—102	.. 4 8 3
541,920	20	Nov. 14	3⅛	Monte Video, Ltd.		10¾—11⅛	.. 6 1 9
1,775,892	Stk.	Aug. 15	4⅜	Newc'tle & G'tesh'd Con.		105—'07	.. 4 6 5
406,025	Stk.	Dec. 30	3⅛	Do. 3½ p.c. Deb.		86—88*	.. 3 19 7
15,000	10	Aug. 29	10	North Middlesex 10 p.c.		19½—20½	.. 4 17 7
55,940	10	,,	7	Do. 7 p.c.		13—14	.. 5 0 0
300,000	Stk.	Nov. 28	8	Oriental, Ltd.		135—138	.. 5 15 10
60,000	5	Sept. 13	7	Ottoman, Ltd.		6—6⅛	.. 5 7 8
398,490	5	Oct. 30	7	Primitiva Ord.		6⅛—7	.. 5 0 0
796,980	5	July 31	5	Do. 5 p.c. Pref.		4⅛—5⅛	.. 4 17 7
488,900	100	Dec. 2	4	Do. 4 p.c. Deb.		92—94	.. 4 5 1
1,000,000	10	Oct. 11	8	River Plate Ord.		13—13⅜	+⅛ 5 18 6
312,650	Stk.	Dec. 30	4	Do. 4 p.c. Deb.		90—92*	.. 4 7 0
250,000	10	Sept. 27	8	San Paulo, Ltd.		13—13⅛	.. 5 18 6
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.		46—48*	+½ 5 4 2
135,000	Stk.	Sept. 13	10	Sheffield A		244—246	.. 4 1 4
209,984	,,	,,	10	Do. B		244—246	.. 4 1 4
523,500	,,	,,	10	Do. C		244—246	.. 4 1 4
70,000	10	Nov. 14	10	South African		14⅛—15⅛	.. 6 9 0
6,429,895	Stk.	Aug. 15	5⅛	South Met., 4 p.c. Ord.		120—123	+1 4 9 5
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.		81—83	.. 3 12 3
201,720	Stk.	Sept. 13	8	South Shields Con. Stk.		154—156	—1 5 2 7
605,000	Stk.	Aug. 15	5⅛	S'th Suburb'n Ord. 5 p.c.		114—117	.. 4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.		117— 20	.. 4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.		120—125	.. 4 0 0
502,310	Stk.	Nov. 14	5	Southampton Ord.		104—109	.. 4 11 9
120,000	Stk.	Aug. 15	6⅜	Tottenham and 4 p.c. Deb.	A 5 p.c.	'20—123	.. 5 9 9
398,940	,,	,,	5⅛		B 3⅛ p.c.	100—103	.. 5 1 11
149,470	,,	Dec. 13	4	Edmonton 4 p.c. Deb.		97—100	.. 4 0 0
182,380	10	Dec. 30	8	Tuscan, Ltd.		10¼—10¾*	.. 7 8 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		98—100*	+½ 5 0 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.		107—109	.. 4 11 9
30,000	Stk.	Feb. 14	8	Wands-worth and	A 5 p.c.	—	.. —
255,636	,,	Aug. 15	6⅜		B 3⅛ p.c.	128—133	.. 4 17 9
75,000	,,	,,	5⅜		C 3⅛ p.c.	—	.. —
80,075	,,	Dec. 30	3	Putney 3 p.c. Deb. Stk		73—75*	—½ 3 16 11
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.		100—103	.. 4 19 6
185,000	,,	,,	5	Do. 5 p.c. Pref.		118—120	.. 4 3 4
228,300	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.		99—102*	.. 3 18 5

Prices marked * are "Ex div."

combination, the city would be recouped the greater part of the expense already incurred in building reservoirs and in laying trunk mains. The cost of constructing the third reservoir would be undertaken by the Water Board; and the fourth reservoir need not be put in hand for many years to come. Water could be supplied by the Water Board in bulk at an even rate per 1000 gallons consumed; and the receipts therefrom should be sufficient to meet the expenses of the Water Board for interest, sinking fund, maintenance, and management, without the imposition of a rate-in-aid. The position of Swansea is the reverse of that of Cardiff, as Swansea has in the Cray reservoir much more water than can be used in the district, and has to bear the burden of large works, only a small portion of the water from which can be sold. If the works were purchased by a Water Board, the whole, or nearly the whole, of the water could be rendered remunerative at an early date; and the burden would be proportionately reduced. Were Swansea to join the combination, the Cray reservoir and the trunk mains connected with it would be purchased by the Water Board, and a supply in bulk afforded.

The Engineers, in conclusion, recommend that a Water Board for the whole of the county, including Cardiff and Swansea, be established by Act of Parliament, the Board to be constituted of members to be appointed by the Local Authorities in a manner to be determined. That the sources of supply belonging to the existing Local Authorities be purchased by the Water Board; the basis of the purchase to be the prime cost of the works, less depreciation, and any money that may be necessary to put the works in proper repair. That the whole of the water undertakings of the various Water Companies be taken over by the Board; and that the distributing machinery be sold to the respective Councils within the county within whose area it lies, or for whom it is available. That the sources of supply should be paid for by bonds of the Water Board issued over such period as Parliament will allow, and to be guaranteed by the county fund. That the authorized sources of supply should be purchased in connection with the Dringarth and Llyn Fawr reservoirs, so far as they have been carried out, at cost price; and that powers should be secured, and funds provided, for laying mains from the Cray reservoir to Llyn Fawr, and from the head of the Rhondda Valley to the Ogmore and Garw Valleys to Glyncorrwg and Maesteg, also from the Cray reservoir down the Aberdare Valley to Pontypridd, and from the Dringarth reservoir to connect with both mains. That no water authority should be injured by the system of redistribution, or have their supply of water reduced thereby to less than 25 gallons per head of the population actually supplied. That should any water authority fail to provide adequately for the requirements of the population within their area of supply, the Water Board should be empowered, after due inquiry, to undertake the supply and collect the rents. That the Water Board shall have power to promote Bills in Parliament to acquire land and construct water-works. The sale of water in bulk, it is estimated, at 4¼d. per 1000 gallons, should provide an income sufficient to cover ordinary expenditure, but insufficient to provide for interest on new works during construction or until fully utilized.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In connection with the proposal of the Edinburgh and Leith Gas Commissioners to apply for a new Provisional Order, a document containing explanatory memoranda has been circulated among the Commissioners. In this it is stated that the works for the completion of which an extension of time is required are: The construction of a sea wall or embankment involved in the reclamation scheme of about five acres of foreshore; a pier or jetty for the convenience of loading and unloading merchandise brought by seaboard; a new road to replace one to be acquired and closed; and the diversion of a drain in that road. These works were authorized in the original Act of 1898, and the right to execute them was acquired as part of the land purchase scheme from the Duke of Buccleuch. They are valuable and important to the undertaking; and it is necessary that the Commissioners should preserve all their rights and privileges with regard thereto. As the time for their completion expires within two years, it is necessary to ask the authority of Parliament for an extended period during which these works may be carried out. By resolution of the Commissioners on May 28, 1906, it was agreed that, on a vacancy occurring in the office of Treasurer or Collector, the Commissioners should dispense with one or other of these offices, and should apply, on the first suitable occasion, for authority to do so, as at the present time they must by statute have a Treasurer and Collector in the form of two persons. A proposed pension scheme is to be of a contributory character, and based as far as possible on the lines recently adopted by the Edinburgh Corporation. The proposal to reduce the candle power of the gas is a permissive application and not a direct intention, as the Commissioners determine, year by year, what illuminating power shall be supplied; so that they may adjust their policy to the public requirements as often as necessity arises, provided always that they do not reduce below the standard minimum. The 14-candle gas is the one now generally adopted in gas legislation, and is the figure mentioned in the Model Clauses (1907), which have been framed for inserting in all Gas Bills coming before Parliament. Opportunity will also be taken to include in the Order the Model Clauses that have recently been framed and authorized relative to gas testing, gas-testing apparatus, and other provisions for the public interest. The proposal to increase the borrowing powers of the Commissioners is in order to buy up the annuities which were granted at the time of the acquisition of the properties from the two Gas Companies. Currie and Balerno are not in the compulsory area of supply, although gas is supplied in bulk to Currie; and as it is anticipated that these districts are likely to develop, and, further, that to give them an adequate supply of gas it will be necessary in the near future to supplement the distributing system in the localities adjoining, it is important that the areas outside the boundary, and for which these extensions are partially necessary,

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should be secured within the Commissioners' statutory area, and thus prevent a private company stepping in when development has taken place. The provision to charge differential rates for gas is now a recognized commercial necessity. It is accomplished in the case of large consumers for lighting on the basis of discounts, ranging from 2½ to 10 per cent., in relation to consumption; and, further, the Commissioners have power, where gas is used for engine purposes, principally during the day time, to sell such gas at a lower rate, subject to certain restrictions. There are, however, many other industrial purposes for which gas is eminently applicable, and particularly where daylight supply is required all the year round, that are not met by the present provisions; and it is thought the Commissioners should have full powers to make special terms for special purposes in this respect—thus not only securing the prosperity of the gas undertaking, but also improving the locality by supplying for industrial purposes a cheap source of power free from smoke and dirt.

These memoranda having been considered by a Sub-Committee of the Finance and Law Committee, they recommended that the Commissioners should, as soon as possible, apply: (1) For an extension of time for the completion of the works, the extension to be for a further twelve years—say, till Whitsunday, 1922; (2) for power to arrange as to the amalgamation of the offices of statutory Treasurer and Collector, or the extinction of one or other of these offices; (3) for authority to grant pensions or allowances to permanent employees, the pension scheme to be on lines as similar as possible to the pension scheme of the Edinburgh Corporation; (4) for reduction of the candle power of the gas authorized, and provision for the testing of the gas in conformity with the new Model Clauses; (5) for increased borrowing powers beyond the £1,400,000 already authorized, to enable annuities to be compulsorily redeemed at and after Whitsunday 1909, if thought advisable; (6) for a provision that the Commissioners should be entitled to temporarily discontinue or interfere with the supply of gas to enable them to make connections, and that they should not be responsible for interference with gas supply caused by any unavoidable casualty; (7) for an extension of the Commissioners' area of supply by including therein Currie and Balerno; and (8) for power to charge differential rates as between gas supplied and used for private lighting and for any other purposes to which it may be applied. The Sub-Committee also considered the subject, and were of opinion that the Commissioners should not seek power to increase the minimum contributions to the sinking funds or the reserve fund. The Sub-Committee had under consideration a report by the Engineer, to the effect that, almost without exception, the most recent Gas Orders provided that the official testing-place should be inside the works, or within 200 yards therefrom; and they also considered a memorandum which had been prepared by the Clerk, in which it was stated that, as the two old Gas Companies had separate testing-places, the Commissioners considered where their official testing-place or places should be, and in December, 1888, resolved that they should be at the places fixed by the two Gas Companies—viz., 25, Waterloo Place, Edinburgh (the offices of the Commission) and the Baltic Street works in Leith; the one being for the testing of gas made at the New Street (Edinburgh) works, and the other for the gas made at the Leith works. There being nothing to prevent the Commissioners from time to time altering the situation of their official testing-place or places, the Commissioners in October, 1899, altered the testing-place from Waterloo Place to the New Street works. The Act of 1898, authorizing the erection of the Granton works, did not contain any special provision as to a testing-place for the gas to be made at these works; but the provisions of the Act of 1888, so far as applicable and not inconsistent, were made applicable. The Commissioners accordingly, as part of their arrangements in connection with the Granton works, by October, 1903, installed there a new testing-place, which was at work as soon as gas was being made there for public distribution. Notification of all these testing-places was duly made to the Corporation of Edinburgh, and, without demur, the Official Gas Examiner thereafter made his tests there. The testing-places at the New Street Gas-Works and the Leith Gas-Works have been dismantled for some considerable time. It was only the Gas Commissioners who were authorized to fix where their testing-place was to be; and the Official Gas Examiner must make his tests there. The Sub-Committee were of opinion that the Commissioners should make no change in their official testing-place, but that it should be continued at the Granton works.

When these recommendations came before the Commissioners at their monthly meeting on Monday last, Judge Bryson moved their adoption. As to the proposal to reduce the illuminating power of the gas, the authority they asked was only to do so if they thought fit; and it was only asking a power which almost every other gas undertaking in the country had. Bailie Maxton, in seconding, said it was well known that 75 per cent. of the gas consumers used incandescent gas appliances; and the power they were asking would enable them to give gas which would be equally efficient for lighting and heating. Mr. Stewart thought that if they did not intend to adopt it, they did not require to take the power. In the interests of many consumers who did not yet use incandescent burners, he moved that they do not see the necessity for reducing the candle power below 20 candles. Bailie Carmichael, in seconding, said they were proposing to supply a poorer gas and charge the same price for it; and if they got the power, they would be likely to exercise it. The recommendations of the Committee were adopted by sixteen votes to two.

On the 24th ult., these "Notes" contained a statement with reference to the proposal that the Corporation of Glasgow should supply gas in the district of Giffnock. My remarks were a little critical of the proposal. There is a comment upon the same subject, which I cull from a newspaper, and which is written in a spirit the opposite of critical. "The Engineer of the Gas Department," it is stated, "has reported on a proposal to extend the Corporation gas-mains to Giffnock. The existing mains are within 1500 yards of Giffnock, on the Kilmarnock Road; and the estimated capital cost of laying mains and pipes in Giffnock is £3000. In the Newlands district, which is supplied from the main in Kilmarnock Road, the consumption has increased from 9 million cubic feet in 1901 to 21 millions in 1907. Rouken Glen Park and the lands of Hutcheson's Hospital are in the parish of Eastwood, and will need a supply of gas. The Gas Department have also received

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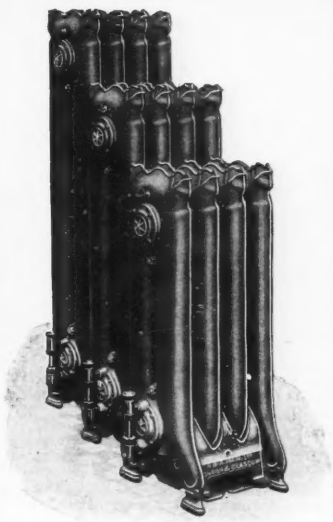

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applications for a supply for power and lighting purposes for the quarries at Giffnock. The gas supply in Giffnock is at present furnished by a private Company at Busby, distant about 1½ miles, introduced into Giffnock by that Company in 1888. If the request now made to the Glasgow Corporation for a supply of gas is refused, it might, as in the recent water question in the same area, result in the Corporation losing their statutory powers in the parish of Eastwood, in the event of statutory powers being obtained by any company. The Gas Committee recommended the Corporation to proceed with the extension of mains to Giffnock, and to offer to purchase, at a fair valuation, the Busby Gas Company's mains and pipes already laid in that area. The Town Council are acting on that recommendation."

In the Elgin Town Council on Monday, the Gas Manager—Mr. J. Kay—reported that the Convener and he had examined the tenders for supplying the new gasholder; and the Committee recommended that the offer of £3650, by the Barrowfield Iron-Works, Limited, of Glasgow, being the lowest, should be accepted. Bailie Gordon, the Convener of the Gas Committee, said there were ten offers, ranging up to £4725. He moved that the offer be accepted; and this was agreed to.

The output of gas from the works of the Inverkeithing Gas Company, Limited, was reported to the shareholders at their annual meeting at the end of last week to have been the largest on record. A dividend of 6¼ per cent. was declared.

The Falkirk Town Council, along with a few invited citizens, yesterday afternoon paid their second annual visit of inspection to the new Corporation Gas-Works. These were found to be, in every department, in first-class order. During the afternoon tea was served to the company in the exhauster and meter house. Provost Christie proposed the sentiment of "Success to the Gas Undertaking," and in doing so said they had all enjoyed, and been benefited by, their visit to the works. They had been more and more impressed with the vastness and the importance of the department which was represented there. Those of them who only visited the works periodically must have been struck with the progress which was always being made, and the improvements which were being effected in the methods of gas manufacture, and also with regard to the labour-saving appliances in these works. They were also impressed with the great business which was being carried on in that department. Whatever progress there might be in other matters, the demand for gas was continually on the increase. In the meantime, they were able to cope with all that was required by the town and district in the matter of gas supply; but the increase of Falkirk would no doubt mean a greater increase in the provision for making gas there. Bailie Bogle, the Convener of the Gas Committee, was sure they were all extremely pleased with their walk round the works. It was a huge undertaking for a place like Falkirk. The Town Council had, however, shown a large amount of public spirit, in looking so far into the future as they had done, when they erected gas-works suitable to cope with the growing prosperity of Falkirk for many years to come; additions to plant only being now required. When they looked at the works, they saw the finest specimen of gas-works in the United Kingdom. They had taken advantage of the newest ideas in the manufacture of gas. It was all very well to see gas burning at the jet; but it was better still when they could understand the very beginning of gas, and observed all the details of its manufacture. The works had not been finished without much labour on the part of the officials, and much searching of mind on the part of the Municipality. That day they had seen what was almost the culmination of their efforts with regard to gas production. In those efforts they had been greatly aided by their able Gas Manager—Mr. Wilson—who spent the whole of his time in furthering their gas undertaking. He had pleasure in proposing his health. Mr. W. Wilson, in responding, echoed what Bailie Bogle had said as to the equipment of the gas-works. They were in the first rank; and, with the addition of a few details, he did not see any reason why, in the future, Falkirk should not be supplied with the cheapest gas in the United Kingdom.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan* 4.

Sulphate of Ammonia.

Business has again been interfered with by holidays; but, notwithstanding this, there has been a fair amount of buying at a slight improvement upon last week's values. The closing prices are £11 15s. per ton f.o.b. Hull, £11 17s. 6d. to £11 18s. 9d. per ton. f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There is nothing to report in forward business. Makers, on their part, are looking for a substantial premium on spot prices; while buyers, being uncertain as to the course of the market over the spring months, seem inclined to await developments.

Nitrate of Soda.

The strike at the shipping ports being at an end, the market has eased off, and at the close the quotations are down to 11s. 1½d. and 11s. 4½d. per cwt. for 95 per cent. and refined qualities respectively, less 2½ per cent., *ex* store.

LONDON, *Jan.* 6.

Tar Products.

The markets are still quiet all round; and it is to be feared that the New Year does not open very encouragingly as to prices obtainable for products, which, with the exception of creosote, are mostly lower than was the case twelve months ago. Pitch is very quiet; and business has been done on the east coast at 20s. for this season, and 22s. for next season. Creosote remains firm, without very much business doing, though prices are steady. Benzol 90 per cent. is unchanged; there being sellers in the North at 8¼d. and in London at 8⅜d. Benzol 50-90 per cent. and toluol are unaltered, and there is very little demand for either. Solvent 90-100 and 90-190 are both quiet and difficult of sale. Carbolic acid has been sold on the east coast for January-June delivery at 1s. 6¾d. to 1s. 7d. per gallon. Crystals are neglected. Tar appears to be feeling the effects of the low figures ruling for products.

The average values during the week were: Tar, 13s. to 17s., *ex* works. Pitch, London, 22s. to 22s. 6d. f.o.b.; east coast, 20s. to 21s. f.o.b.; west coast, 19s. 6d. to 20s. 6d. f.a.s. Benzol, 90 per

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Sulphate of Ammonia.

This article is firm. There has been a steadier tone in the market during the last few days, and prices are a shade harder all round. The principal London Gas Companies, who are very well sold, quote £12 5s.; but it is possible to buy outside makes at £11 15s. to £11 17s. 6d. In Hull, the market is £11 16s. 3d. to £11 17s. 6d.; and in Liverpool £11 17s. 6d. to £11 18s. 9d. In Leith, the market is £12 to £12 2s. 6d. Business is reported to have been done at the latter figure, and some makers are said to have refused even this price.

MARKET FOR NITRATE OF SODA LAST YEAR.

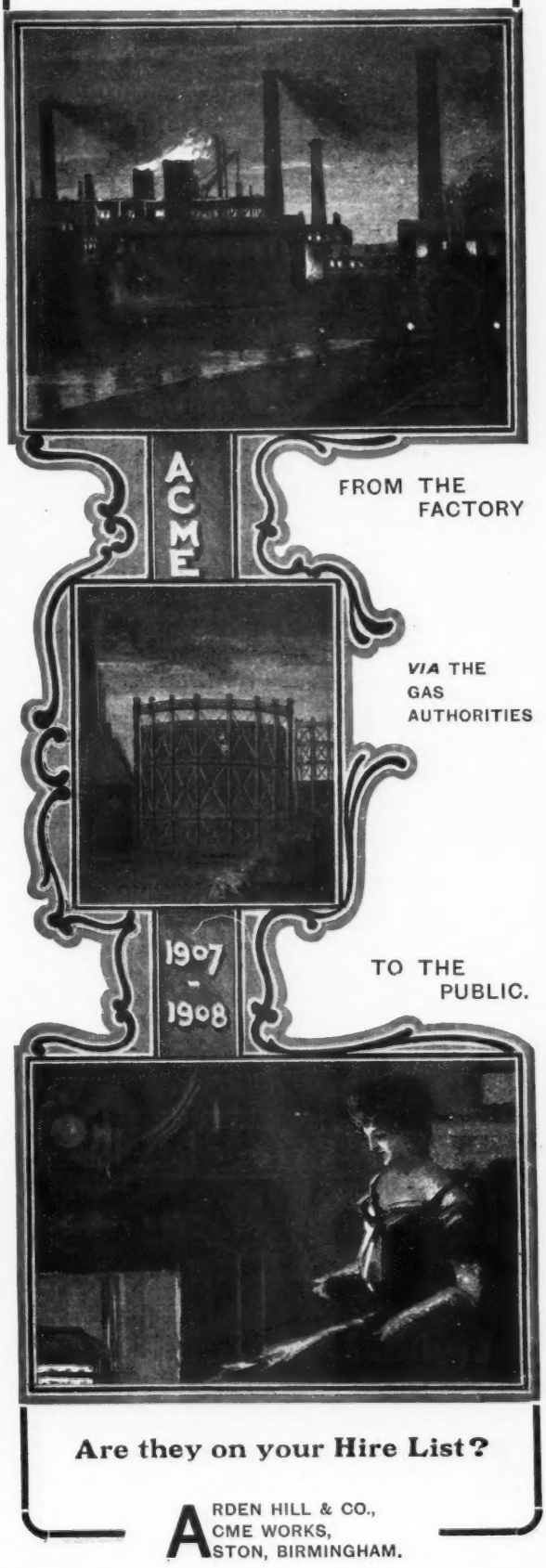
In the last half-yearly report issued by Messrs. W. Montgomery and Co., Limited, on the market for nitrate of soda, the progress of the market in the past year is reviewed. It is stated that the consumption of the article for all parts of the world during the twelve months was somewhat disappointing, as it showed the smallest increase upon its predecessor for the previous five years. The consumption in Europe for the twelve months was 1,257,000 tons, against 1,243,000 tons in 1906; being an increase of 1·11 per cent. Of this quantity, the Continent accounts for 1,145,000 tons, against 1,135,000 tons, or an increase of 0·87 per cent.; while to the United Kingdom is credited 112,000 tons, against 108,000 tons, or 3·57 per cent. more. The United States account for 349,000 tons, compared with 355,000 tons—a decrease of 6000 tons, or 1·7 per cent. In other countries the increase is stated to have been satisfactory at 56,000 tons, against 38,000 tons, or 48 per cent. The production for the eleven months ending Nov. 30 was 36,621,100 quintals, compared with 35,950,742 quintals, or a rise of about 30,000 tons. The December production was not to hand when the report was issued; but it was not expected to reach the figures for 1906 by probably 20,000 to 30,000 tons, owing to a six weeks' strike of stevedores at Hamburg. The shipments for the twelve months to all parts, at 1,628,000 tons, against 1,700,000, show a decrease of 72,000 tons; labour difficulties, bad weather, and heavy surfs at the nitrate ports being accountable for it. The visible supply at 691,000 tons compares with 733,000 tons at the close of 1906; therefore the season commences with 42,000 tons less nitrate in sight. Consequently, should demand be on the same scale as previously, Messrs. Montgomery think prices must necessarily be driven up. Given good weather conditions and lower money rates, they see no reason why the demand in 1908 should be less than in 1907—indeed, they think it is more reasonable to expect it will be larger, by reason of the generally satisfactory financial position of the agriculturist, both in England and on the Continent. The world's consumption of nitrate for the past three years has been as follows:—

	1905. Tons.	1906. Tons.	1907. Tons.
Continent of Europe . . .	1,089,000 ..	1,135,000 ..	1,145,000
United Kingdom	101,000 ..	108,000 ..	112,000
United States	308,000 ..	358,000 ..	349,000
Other Countries	49,000 ..	40,000 ..	56,000
Total . . .	1,547,000 ..	1,641,000 ..	1,662,000
Shipments for the same periods	1,623,000 ..	1,700,000 ..	1,628,000

Fatal Explosion in the Bourse at Rome.—Last Tuesday afternoon, a serious explosion, stated to have been caused by an escape of gas, occurred on the Bourse at Rome. The place was crowded at the time, and about twenty people were injured—one being a porter, who has since succumbed. A report which reached London through the Exchange Telegraph Company said that a man had confessed to being the cause of the disaster; explaining that he struck a match to light a cigarette where gas was escaping.

New Joint-Stock Companies.—The Reliance Incandescent Company, Limited, has been registered with a capital of £6700, in £1 shares, to adopt agreements with A. Gross and others, and to carry on the business of ironmongers, gas-fitters, &c. "George Kent, Limited," is the title of a Company formed with a capital of £145,000, in £1 shares (90,000 preference), to acquire the business carried on by Mr. W. G. Kent and the Trustees of the late George Kent, at 199-201, High Holborn, W.C., as manufacturers of (*inter alia*) water-meters, hydraulic engines, &c. There will be no initial public issue. Mr. W. G. Kent is the Managing-Director and Chairman of the Company for ten years.

Gas v. Electric Light at Wolverhampton.—Owing, it is stated, to some defect in a boiler-tube, with resulting lowering of the pressure of steam, the supply of electric current to Wolverhampton had to be curtailed on the evening of Saturday, the 28th ult., just as business was at its height. Considerable inconvenience was necessarily experienced during the time (about an hour) the plant was shut down, and the current furnished from the storage batteries. A correspondent, writing to a local paper on the subject, questions whether the Corporation are supplying the quality of light the consumers are entitled to expect. At his works he uses incandescent gas-burners and at his house electric light; and his experience is that, light for light, there is no comparison between the two, so great is the balance in favour of gas.



COAL TRADE REPORTS.

Lancashire Coal Trade.

Yesterday witnessed the resumption of work by the miners after the New Year's holidays. There is ample work for them to do. So great has been the demand for coal of all descriptions lately that stocks are practically cleared out. The expected further rise in prices has not yet taken definite shape. In other coalfields—in the Midlands and East Coast districts—trouble is brewing, which may result in still further calls upon Lancashire and more northern collieries for supplies. In the Nottinghamshire district, the men are clamouring for a price list, the outcome of which may possibly be either a strike or a lock-out. At Grimsby and Hull, the trawler owners complain of the increased prices demanded by the proprietors of the South Yorkshire and Derbyshire pits. A conference has been held, and a resolution passed describing the increase of 3s. per ton as prohibitive, and declaring that contracts on such terms should be avoided. They threaten to get coal from other sources. But the question is—How and where can they get supplies? The South Yorkshire and Derbyshire coalowners have taken up a firm attitude in the matter, and adhere to the new terms. The former have also concluded contracts for the North-Eastern Railway Company at 11s. 3d. per ton, as against 9s. 6d. last year.

Northern Coal Trade.

The coal trade is active. The production is barely up to the average, and there is a fuller demand, as the stocks have been reduced in the holiday time. It is probable that shipments of coal from the north-eastern ports will be very heavy for the next week or two. In the steam coal trade, best Northumbrians are from about 12s. 9d. to 13s. 1½d. per ton f.o.b., second-class steams from 12s. 3d. to 12s. 6d., and steam smalls from 6s. 10d. to 7s. In the gas coal trade, there are now good deliveries being made on old contracts, and there are some sales in addition—the more severe weather having increased the heavy consumption. Prices of Durham gas coals vary, according to quality, from about 12s. 3d. to 14s. per ton f.o.b. There is increasing interest attached to the forward sales of gas coals to be made; for the views of buyer and seller seem to differ widely—the more general opinion being that the price may be near 13s. per ton f.o.b., with a higher quotation for the very best Durham kinds, which are still somewhat scarce relatively. In the coke trade, prices are steady. Gas coke is plentiful at from 19s. to 19s. 6d. per ton f.o.b. in the Tyne or the Wear.

Scotch Coal Trade.

Official quotations were not issued last week, on account of the holiday nature of the time. The shipments for the week amounted to 307,866 tons—an increase of 19,585 tons upon the preceding week, and of 51,930 tons upon the corresponding week of last year. For the year, the total shipments were 14,751,060 tons—an increase of 842,691 tons.

Diaries, Calendars, &c, for 1908.

In addition to the pocket-books, &c., for the current year noticed last week, we have received a useful little diary from Messrs. F. C. Sugden and Co., of Leeds. The first few pages are devoted to particulars of their regenerator and generator settings; an illustrated description being given of a setting on the former system with Hudson's patent producer, of which the firm are licensees. The diary carries, as is now usual, an insurance coupon. An appropriate and artistic wall calendar has been sent by Messrs. John E. Williams and Co., of the Victoria Paint-Works, Manchester. The centre-piece represents a painter, having a palette, brushes, and maulstick in his left hand, and using his right to support himself upon a ladder, engaged in conversation with a be-wigged and be-ruffled gentleman—possibly a patron. Both are attired in the dress of the Georgian period, which lends itself to artistic effect much better than that of the present day. Below the picture is a monthly tear-off calendar. We have received from Messrs. Fletcher, Russell, and Co., Limited, a block calendar similar to those sent out in previous years. Above the date each day is an illustration of one of the firm's numerous appliances for the utilization of gas for cooking, heating, and other purposes.

Gas Explosion in Aberdeen.—On the afternoon of Saturday, the 28th ult., an explosion of gas took place in the house of Mr. James Johnstone, at 59, Beechgrove Terrace, Aberdeen. As there was a smell of gas in the drawing-room, on the ground floor, Mr. Johnstone had the door and window opened for an hour or two, and then, the odour being no longer detected, he mounted a set of steps, and began to test the gasalier for a leak. Nothing was found to be wrong till he reached the top, when an explosion occurred, which threw him to the floor and injured him somewhat seriously. The window curtains were set on fire, and considerable damage was done to the building. It would seem that the gas had accumulated in layers along the ceiling, and not to have been dislodged by the opening of the door and window; being, presumably, fed continuously from a leak at or about the universal joint.

Gas v. Electricity for Library Lighting.—The annual report of the Camberwell Borough Council, which has just been issued, contains the following remarks with regard to the lighting of the Central Library: "During the year, the cost of lighting the building by electricity was carefully considered by the Library Committee, and it was decided that something should be done to relieve the library in some degree from the heavy expense incurred. Alderman Hearson, at the Committee's request, submitted a table showing that the comparative approximate cost for lighting the octagonal reading-room by gas and electricity was as follows: Gas, 960-candle power, £11 10s. 5d.; electricity, 656-candle power, £66 8s. 5d. On his recommendation, 24 inverted incandescent gas-burners were afterwards fixed; and the result has fully justified the Committee's action, and proved the above figures to be correct. In addition to the increased light, the expense of making the alterations has been met and £32 2s. 5d. saved."

S&P

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Radford Road, NOTTINGHAM.

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M&N

Companies Wound-up Last Year.—Among the Companies wound up last year by order of the Court were the Arnside Gas Company, the Kent County Gaslight and Coke Company, and the Beverley Water-Works Company.

Extension of the Vienna Municipal Gas-Works.—In the "JOURNAL" for the 29th of October, it was mentioned that the Municipal Council of Vienna had voted a sum of £1,250,000 for the extension of the gas-works. The Council are now preparing to issue a loan of from 250 to 300 million kronen (roughly £10,000,000 to £12,000,000) for this and other purposes, including electric lighting.

Leyton Public Lighting.—At the meeting of the Leyton Urban District Council last Tuesday, the Surveyor reported that he had requested the West Ham Gas Company to substitute incandescent mantles for the existing fish-tail burners in the streets of the district. The Company replied that they would do this subject to an agreement being entered into for two years. The Council could not agree to this condition, but accepted an offer by the Company to supply and fix a better kind of flat-flame burner.

Llandudno Water Supply.—Last Thursday, Mr. H. A. Reed held a Local Government Board inquiry at Llandudno, with reference to the application of the Council to borrow £999, for the purpose of laying a 15-inch water-main from the town to the boundary of the district. The Engineer (Mr. E. P. Stephenson) explained that when the work was completed there would be a 15-inch main to Plas Dulyn, where the service reservoir was situated, except the part between the boundary of the district and Llandudno Junction. This portion would be laid as soon as practicable; but at present the Council were not decided as to which route should be followed. There was hope of a shorter and more level road being opened up to Llandudno Junction, along which it would be preferable that the pipe should be laid.

Exmouth Water Supply.—A special meeting of the Exmouth District Council was held recently to consider the question of the water supply. The Chairman (Mr. J. E. Daw) said that, though the Water Committee had acted with commendable prudence in reducing the supply when the need of economy was felt, the heavy rain of the last few weeks had rendered such precautions unnecessary. It was a serious inconvenience to the people to have the supply of water cut off every evening. At present the reservoir was full to within 13 inches of the overflow; and he calculated that, even if they gave a constant supply, they were receiving sufficient water to enable them to still add to the quantity in store. There was no necessity to wait until the reservoir was actually overflowing before restoring the full supply. It was decided to give a full supply until further orders.

Sydney Gas Supply Imperilled.—We learn from a copy of the "Sydney Daily Telegraph" lately to hand that the gas supply of Sydney, by the Australian Gaslight Company and the North Shore Gas Company, was imperilled by a strike at the collieries from which they derived their coal as well as by the employees at the Commonwealth Oil Company, from whom they buy their oil. The Directors of both Gas Companies expressed their determination to keep faith with the consumers as far as possible; but the Secretary of the Australian Company (Mr. R. J. Lukey) told a representative of the above-named paper that, if the worst came to the worst, the city and suburbs would have to be in darkness. Fortunately, this did not happen; but the trouble is not by any means over, as, according to a Reuter telegram which reached London last Saturday, a partial strike had again broken out in the Newcastle collieries, and a serious extension threatened.

Her Royal Highness, Princess Louise, has ordered personally, to be installed at Kensington Palace, four of Richmond's "Monarch" gas-steam radiators.

In the course of a discussion in the Bolton Town Council, Mr. Heelis said that last year £1800 was saved in the lighting of the borough by incandescent burners.

The Town Council of Wokingham have agreed to accept Messrs. Drake's tender for the installation at the gas-works of new beds of retorts with regenerative settings.

Notice has been given in the "London Gazette" that a first and final dividend of 5s. in the pound will be made in the case of the Arnside Gas Company, Limited, Kendal.

Mr. S. H. Truscott, until recently representing the Davis Gas Stove Company, Limited, has been appointed representative of the Parkinson Stove Company, Limited, for the counties in the South of England.

We learn that a total length of 22,657 feet, or more than four miles, of Clapham's patent "Eclipse" special rubber joint for drylute purifiers has already been ordered, and that it is giving great satisfaction.

It is reported that Fermoy was on Saturday night plunged into semi-darkness through the action of the Gas Company in reducing the pressure. The Urban District Council had refused permission to open the roads to repair dangerous leakages from the mains unless the price of gas were lowered.

The Newark Town Council have considered a proposal by the Notts County Council for joint opposition to the Lincoln water scheme by the County Council and other interested authorities; but they have decided to remain neutral. The Water Committee have been advised by their Engineer (Mr. Henry Rofe) that they will, having regard to the distance of the proposed well from their own Farnsfield pumping-station, be justified in adopting this course.

At midnight last Wednesday, the Old Town, Hull, was enlivened by several loud explosions, by which the covers were forced off various electric street boxes, and some panes of glass in surrounding property were shattered. As the cable was in flames, the fire brigade were summoned, and stood by till the Electrical Engineer was able to assure them that everything was safe again. There is reason for congratulation on the fact that the occurrence did not take place in the daytime, when the streets would have been full of people.

1908.

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GAS AND WATER ENGINEER AND MANAGER. Goole District Council. Applications by Jan. 27.
MANAGER (WASHERY COKE-OVEN WORKS). Powell Duffryn Steam Coal Company.
WORK SUPERINTENDENT (CONSTRUCTION AND ERECTION). "A. K.," Parliament Mansions, S.W.
DRAUGHTSMAN. Tynemouth Gas Company.
DRAUGHTSMAN. No. 4890.
HEAD MECHANIC (GAS-WORKS). No. 4889.
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Situations Wanted.

REPRESENTATIVE. No. 4869.
CHIEF COLLECTOR OR ASSISTANT SECRETARY, &c. (GAS AND WATER). No. 4880.
MANAGER AND SECRETARY (GAS OR WATER). No. 4893.
MANAGER OR ASSISTANT. No. 4894.

Pupil Required. No. 4887.

Plant, &c., for Sale.

MANTLE MANUFACTORY (COMPLETE). Liverpool Incandescent Mantle Company.

Stocks and Shares.

BRIDGWATER GASLIGHT COMPANY (DEBENTURES).
MITCHAM AND WIMBLEDON GAS COMPANY. Feb. 13.
NORWICH WATER COMPANY. Jan. 22.

TENDERS FOR

Fire-Clay Goods.

BURY GAS DEPARTMENT. Tenders by Jan. 17.
COVENTRY GAS DEPARTMENT. Tenders by Jan. 13.
HALIFAX GAS DEPARTMENT. Tenders by Jan. 28.
HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD. Tenders by Jan. 9.
HEYWOOD GAS DEPARTMENT. Tenders by Jan. 14.

General Stores, Lamp Fittings, Oils, Paints, Ironmongery, &c.

HALIFAX GAS DEPARTMENT. Tenders by Jan. 28.

Incandescent Mantles, &c.

PLYMOUTH CORPORATION. Tenders by Jan. 23.

Lime.

HALIFAX GAS DEPARTMENT. Tenders by Jan. 28.

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HALIFAX GAS DEPARTMENT. Tenders by Jan. 28.

Oxide of Iron (New and Spent).

HALIFAX GAS DEPARTMENT. Tenders by Jan. 28.

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HALIFAX GAS DEPARTMENT. Tenders by Jan. 28.

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Sulphuric Acid.

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Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1908, are reminded that this can only be done during the current month.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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ADVERTISEMENT No. 4879.

APPLICANTS for the Post of Draughts- man advertised on the 10th of December, 1907, will kindly note that the VACANCY HAS NOW BEEN FILLED.

MANAGER, Dolgelly Gas and Coal Company, Limited.

The Secretary THANKS Applicants, and begs to Inform them that the APPOINTMENT HAS BEEN FILLED.

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Address No. 4894, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CHIEF Collector (Water or Gas). Gentleman (Age 35), at present engaged with important undertaking, and showing High-Class record for Initiative and Ability in every Department (including Court Claims), desires CHANGE indicating better opportunities for Advancement. The matter of an Appointment as ASSISTANT-SECRETARY or SUPERINTENDENT of Collectors would also be treated in confidence or through Solicitors.

Address No. 4880, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, Manager to Take Charge of Washery Coke-Ovens and Bye-Product Works. Previous Experience necessary.

Apply, with Particulars and Salary asked, to the POWELL DUFFRYN STEAM COAL COMPANY, LIMITED, Aberaman Offices, ABERDARE.

WANTED, by a firm of Gas Engineering Contractors, a Competent Young Man as DRAUGHTSMAN, who can also Take Out Quantities for Estimating. Salary, 45s. to 50s. per week.

Apply, by letter, stating Age and Experience, to No. 4890, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SLOT Collector wanted by a Gas Com- pany in Kent. Previous Experience necessary. Preference given to one conversant with the routine of a Gas Office. Wages, 25s. per week.

Apply, by letter, stating Age, Height, and present Employment, to No. 4891, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Gas-Works in the North of England making over 500 Millions per Annum, a Steady, Capable man as HEAD MECHANIC in the Works. Must be thoroughly conversant with Gas-Works Routine and Management. Skilled Mechanical Training indispensable. Age 30 to 40.

Applications, in own hand-writing, stating Age, Experience, and Wages required, and accompanied by *copies* of Two recent Testimonials, to be addressed, not later than the 20th inst., to No. 4889, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GOOLE URBAN DISTRICT COUNCIL.

APPLICATIONS are invited for the Appointment of ENGINEER and MANAGER of the Gas and Water Undertakings of the above-named Council.

The Salary will be £200 per Annum, payable monthly; and the person appointed will be required to reside in the District.

Applications (on prescribed Forms to be obtained on receipt of stamped addressed foolscap Envelope), stating Age, Qualifications, and Experience, together with *copies* of Two recent Testimonials, to be sent to the undermentioned not later than noon on the 27th of January, 1908, endorsed "Gas and Water Engineer."

Canvassing, directly or indirectly, will be a disqualification.

By order,
ROBERT TYSON,
Clerk to the Council.

Council Offices, Goole,
Jan. 3, 1908.

THE Engineer of a large Provincial Gas- Works, with modern equipment, has a VACANCY FOR A PUPIL. Moderate Premium, returned in Salary. Good Education and some aptitude for Chemistry and Drawing essential.

Address No. 4887, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PRACTICAL Man Wanted for the Continent to SUPERINTEND the Construction in the Shops and the Erection of Gasholders and other Gas-Making Plant. Permanent berth for a suitable Candidate.

Apply to "A. K.," Parliament Mansions, Victoria Street, LONDON, S.W.

NIGHT FOREMAN.

WANTED, immediately, an Ex- perienced General CARBONIZING and WORKS NIGHT FOREMAN, for a Works producing 500 Millions per Annum, one who thoroughly understands Machinery as used in a Gas-Works, and who should have held a similar Appointment elsewhere. House, Coke, and Gas free.

Apply, stating Age, Wages, &c., required, together with not more than Three *copies* of recent Testimonials, to No. 4892, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN.

WANTED a thoroughly Experienced DRAUGHTSMAN accustomed to Design of Buildings and Steel Structures, and with a good knowledge of Engineering Practice generally. One who has had some Experience in Design and Construction of Gas-Works Plant preferred. Salary £3 per week.

Apply, stating Age, and giving Particulars of Experience, to WILLIAM HARDIE, Engineer, Tynemouth Gas Company, NORTH SHIELDS.

TO Gas Managers, &c., Wanted, Old Condemned GAS-METERS, from 1-light to 1000-light, for destruction to re-claim Metals. Write for Prices, Stating Quantities and Sizes, and if Wets or Drys. Scrap Metals, Drosses, Metal Shop Sweepings, &c., also bought.

J. WILSON, Pleasant Grove, York Road, King's Cross, LONDON, N.

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WROUGHT Iron or Steel Oval Blanks supplied largely for this purpose. Last longer than Cast Iron. Sheared to Pattern.

Apply, THOS. W. WARD, LTD., Silvertown, LONDON, E.

£150—A small Incandescent Mantle Manufactory, in complete working order, comprising 6 H.P. National Gas-Engine, Gasometer, Condenser, 2 Knitting, 3 Winding, 2 Dipping, 1 Impregnating, 5 Burning, and 1 Trimming Machines, Office Furniture, and Safe. Rent £40. Labour very cheap.

THE LIVERPOOL INCANDESCENT MANTLE COMPANY.

HEBDEN BRIDGE AND MYTHOLMROYD GAS BOARD.

THE above Gas Board are prepared to receive TENDERS for the Supply of RETORTS and FIRE-CLAY GOODS required during the Year ending Dec. 31, 1908.

Further Particulars may be obtained on Application to E. J. WELLENS, Engineer and Manager, Gas Offices, Market Street, Hebden Bridge.

Tenders to be addressed to Councillor James Simpson, Chairman of the Board, Gas Board Offices, Hebden Bridge, and delivered not later than the 9th day of January, 1908.

R. CRABTREE,
Clerk to the Gas Board,

Gas-Works, Hebden Bridge.
Dec. 30, 1907.

THE Gas Committee of the Corporation of Heywood are prepared to receive TENDERS for the Supply of RETORTS and FIRE-CLAY GOODS.

Specification and Quantities and Form of Tender may be obtained upon Application to Mr. W. Whatmough, Gas Manager.

Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.

Tenders, endorsed "Retorts and Fire-Clay Goods," to be sent to me not later than Tuesday, Jan. 14, 1908.

By order,
GEO. G. BOUCHIER,
Town Clerk.

Municipal Buildings, Heywood,
Dec. 31, 1907.

PLYMOUTH CORPORATION.

(STREET LIGHTING DEPARTMENT.)

THE Plymouth Corporation are pre- pared to receive TENDERS for the Supply of the Undermentioned STORES during the Twelve Months ending March 31, 1909.

GAS-MANTLES, &c.

Copies of Specification may be obtained on Application to the undersigned not later than Jan. 20, and on a deposit of 10s. for each copy, which will be returned on receipt of a *bonâ-fide* Tender upon the prescribed Form and within the stated time.

Sealed Tenders, clearly endorsed outside, to be delivered to the undersigned not later than Thursday, Jan. 23, at Four p.m.

(Signed) E. G. ORELL,
Borough Electrical Engineer.

Prince Rock, Plymouth,
Dec. 30, 1907.

TO RETORT AND FIRE-BRICK MANUFACTURERS.

THE Corporation of Bury are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, and FIRE-CLAY required at their Gas Works.

Forms of Tender may be obtained from Mr. H. Simmonds, Engineer and Manager, Gas-Works, Bury.

Tenders, sealed and endorsed, to be sent to the Town Clerk, Bury, not later than Friday, Jan. 17, 1908.

TO FIRE-BRICK MANUFACTURERS.

THE Gas Committee of the Coventry Corporation invite TENDERS for the whole of the FIRE-CLAY GOODS, required for Setting 32 Beds, each of Eight Through Retorts, 20 feet long, including all Materials for the Regenerators and Producers therefor. The Retorts will be sectional, and the whole of the Material for Retorts, Tiles and Special Sections for Regenerators, to be machine-pressed to ensure accurate fitting together.

Form of Tender, with Specification and Schedule of Quantities and Drawings, may be obtained on Application to the undersigned and on payment of One Guinea, which will be returned on receipt of a *bonâ-fide* Tender.

The Committee do not bind themselves to accept the lowest or any Tender.

Tenders must be delivered, sealed, not later than Nine a.m. on Monday, the 13th day of January, 1908, addressed to the Chairman of the Gas Committee, Gas-Works, Coventry.

FLETCHER W. STEVENSON,
Engineer and General Manager.

Gas-Works, Coventry,
Dec. 20, 1907.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation invite TENDERS for the Supply of: (1) CAST-IRON PIPES; (2) WROUGHT-IRON TUBES and FITTINGS; (3) OILS, PAINTS, &c.; (4) CLEANING WASTE; (5) BRUSHES; (6) IRREGULAR PIPES and CASTINGS; (7) BRASS LAMP FITTINGS; (8) BRASS MAIN COCKS and UNIONS; (9) OXIDE OF IRON; (10) SULPHURIC ACID; (11) LIME; (12) IRONMONGERY; (13) STEEL GOODS; (14) FIRE-CLAY GOODS; (15) IRON VALVES and CONNECTIONS; (16) Wet and Dry METERS; (17) TARRED GASKIN, &c.; and for the Purchase of SPENT OXIDE OF IRON, during the Twelve Months ending March 31, 1909.

Forms of Tender and further Information may be obtained on Application to Mr. J. Wilkinson, F.C.S., Engineer, Gas-Works, Halifax.

Tenders, properly endorsed, must be sent to the undersigned on or before Tuesday, the 28th of January.

The persons whose Tenders are accepted for the supply of the above-mentioned Articles will be required to observe the Fair-Contracts Clauses adopted by the Corporation.

The Committee do not bind themselves to accept any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including in these Periodical Sales Gas and Water Stocks and Shares belonging to Private Owners, can be obtained on Application to MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

CITY OF NORWICH WATER-WORKS COMPANY.

(INCORPORATED BY THE CITY OF NORWICH WATER-WORKS ACT, 1850.)

SALE BY TENDER OF £10 ORDINARY SHARES.

THE Directors invite Tenders (at not less than the value of £16 5s. per Share) for the Purchase of 500 ORDINARY £10 SHARES in the above-named Company, being part of the Share Capital authorized to be raised under the Powers and Provisions contained in the City of Norwich Water-Works Act, 1904. The Shares are fully paid up, and are entitled to a maximum Dividend of Six per cent.

Payment for the Shares is to be made on or before the 22nd of January, 1908, from which date the Dividend will accrue.

Tenders will be considered for any number of Shares, whether large or small, within the limited amount issued.

The Company do not bind themselves to accept any Tender, or, in the event of accepting the price offered in any Tender, to issue the full number of Shares applied for.

Tenders, marked "Tender for Shares," must be sent so as to be received at the Secretary's Office on or before the 15th day of January next.

The Dividends Paid on the Ordinary Shares for the last Fourteen Years have been at the maximum rate of Six per Cent. per Annum.

The money to be raised by the issue of the Shares now offered is required for Extension of Works to meet the increasing demand for Water, and for general working purposes.

The Shares will be registered in the Company's Books, and the Certificates issued in the names of the Purchasers, free of expense.

The Dividends on the Ordinary Shares are payable on the 1st of July and the 1st of January in each Year.

By order of the Directors,
G. CHRISTOPHER DAVIES,
Secretary.

11, Prince of Wales Road,
Norwich, November, 1907.

MITCHAM AND WIMBLEDON GAS STOCK.

By order of the Directors of the Mitcham and Wimbledon District Gaslight Company.

OGDEN, SONS, AND OLLEY have received Instructions to SELL BY AUCTION, at the Prince of Wales Hotel, Wimbledon Station, on Thursday, Feb. 13, 1908, at Seven o'clock precisely, in Lots of £100, £50, and £25 each,

£20,000

CONSOLIDATED ORDINARY STOCK.

IN THE

MITCHAM AND WIMBLEDON DISTRICT GASLIGHT COMPANY.

Standard Dividend, £5 per cent. per Annum (subject to the Sliding-Scale).

Particulars and Conditions of Sale may be obtained of the SECRETARY of the COMPANY at the Company's Offices, Western Road, MITCHAM, and 20, Hill Road, WIMBLEDON; of Messrs. NIGHTINGALE, PHILLIPS, and PAGE, Land Agents and Surveyors, KINGSTON-ON-THAMES; and of the AUCTIONEERS, at their Offices, 4, High Street, WIMBLEDON COMMON, and 4, Hill Road, facing WIMBLEDON RAILWAY STATION.

BRIDGWATER GASLIGHT COMPANY.

Incorporated by Act of Parliament. 4 William IV. Cap. 33, and 3 Edward VII. Cap. 19.

FIRST ISSUE OF DEBENTURE STOCK.

THE above Company are offering for Sale, at Par, a limited quantity of 4 per cent. PERPETUAL DEBENTURE STOCK. Interest payable Half-Yearly on the 15th of January and the 15th of July.

Full Particulars and Conditions of Sale, &c., may be obtained on Application to

J. HUGHES CORNISH,
Secretary.

Bridgwater Gas-Works,
Dec. 30, 1907.

F'Cap. Quarto, pp. 584 and XVI. 251 Illustrations. Price 18s. net (Post Free in the United Kingdom).

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FOR

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THOMAS DUXBURY & CO.,
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Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON AND ALL OTHER GAS APPARATUS.
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GENERAL ENGINEERS & IRONFOUNDERS.

Makers of Cast-Iron PIPES and CONNECTIONS for Gas, Water, Steam, Electrical, Sanitary, and other purposes; also TANKS, COLUMNS of every description, Hydraulic, Gas, and Colliery PLANT, &c.

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MIRFIELD GAS COAL.

UNEQUALLED.

Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analyses, and Report, to the

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Rich in Illuminating Power and yield of Gas.

Above the Average in Weight and Quality of Coke.

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Highest Results in Gas, & Excellent Coke.

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Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.

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